

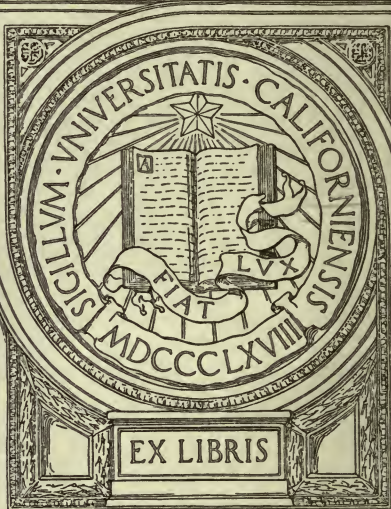
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THE
ANATOMICAL REMEMBRANCER;
OR,

Complete Pocket Anatomist:

A CONCISE DESCRIPTION OF THE BONES, LIGAMENTS, MUSCLES, AND VISCERA;

Nerves, Blood-Vessels, and Absorbents;

THE

AND THE ORGANS OF THE SENSES.

Eighth Edition.

NEW YORK:
WILLIAM WOOD & CO.

1877.

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PREFACE TO THE EIGHTH EDITION.

THIS work has rapidly passed through several editions, and in issuing another the editor has endeavoured, without any material alteration, to preserve the original character of the work, and make it calculated to assist alike the practitioner and the student.

The present edition has been carefully revised throughout, and those alterations which have seemed desirable have been introduced in their proper places.

October, 1876.

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THE ANATOMICAL REMEMBRANCER.

MINUTE STRUCTURE OF BONE.

BONE is composed of an animal and an earthy portion in intimate union. The former (33.3 per cent.) may be almost entirely resolved into gelatin; the latter (66.6 per cent.) consists mainly of the phosphate and carbonate of lime, with a small amount of fluoride of calcium, phosphate of magnesia, and chloride of sodium. It is surrounded by a vascular fibrous membrane (periosteum); the long bones are lined with an internal membrane (medullary). The outer portion of a bone is hard and compact, and passes by degrees into the inner, which is spongy or cancellated. The arteries of bone, which are numerous and of small size, run in small bony canals (Haversian), which vary from $\frac{1}{1000}$ th to $\frac{1}{200}$ th of an inch in diameter; the larger ones, moreover, contain marrow. These canals are short, run chiefly in the long axis of the bone, and communicate frequently by small transverse branches, thus maintaining a free communication between the vessels of the periosteum and those of

the medullary membrane. Each Haversian canal is surrounded by a series of concentric rings (lamellæ) varying in number from eight to fifteen, among which are seen numerous dark spots called lacunæ. Besides the concentric lamellæ, there are some which run parallel with the outer and inner surfaces of the bone, called circumferential lamellæ, while there are others which pass between the Haversian systems, called interstitial lamellæ. The lacunæ are small cavities from which issue minute canals (canaliculi) $\frac{1}{16000}$ of an inch in diameter, which communicate freely with the canaliculi of adjacent lacunæ. The Haversian canal, with its concentric lamellæ, lacunæ, and canaliculi, is termed an Haversian system; and the spaces seen between adjoining systems are called Haversian spaces. Nerves and lymphatics have been traced into the substance of bone.

The medullary canal, the cancellous texture, and the larger Haversian canals are filled with marrow. In the adult this is composed of fat (96 per cent.), fluid with extractive matters (4 per cent.). In the articular ends of long bones, the diploë and the short bones, it is red, and contains only a trace of fat, 25 per cent. consisting of albumen, fibrin, and extractive matters, the remainder being composed of water. In young bones the marrow is also red and free from fat.

Bone is developed mainly from temporary carti-

lage, but occasionally from membrane. The process consists in the deposit of the earthy salts in the interior of the cartilage at certain points, called centres of ossification, from which it spreads throughout the entire mass. The period of ossification varies from the second to the eighth month of foetal life.

The epiphyses ossify after birth, and become united to the main bone inversely to the order of the appearance of their ossification.

OSTEOLOGY.

The skeleton is composed of 200 bones:—

The spinal column.	26
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The spinal or vertebral column supports the head, and is supported by the pelvis. The bones which enter into its formation are called *vertebræ*, of which there are two classes, the *moveable* and the *united*.

The moveable vertebræ, twenty-four in number, are subdivided into three groups—viz., seven *cervical*, twelve *dorsal*, and five *lumbar*.

The United or fixed vertebræ are coalesced to form two pieces—viz., the *sacrum* and the *coccyx*, both of which bones enter into the formation of the pelvis.

GENERAL CHARACTER OF A VERTEBRA.

The body, a mass of bone forming the anterior part of a vertebra. It is thick, spongy, and presents a number of small apertures for the nutrient vessels. It is connected with the bodies of the vertebræ above and below by the intervertebral fibro-cartilages.

Pedicles are two thin portions of bone which connect the sides of the body with the laminæ. They are grooved above and below, *intervertebral notches*, the lower one being usually the deeper.

Laminæ, two lateral plates, which pass backwards from the posterior part of the body, and meet in the middle line behind to form the *spinous process*. The upper and lower borders are rough, for the attachment of the *ligamenta subflava*.

Two transverse processes pass outwards from the sides of the laminæ.

Four articular processes, two upon the upper and two upon the lower surfaces of the laminæ at the roots of the transverse processes, articulate with the articular processes of the vertebræ above and below.

All these processes differ from the body in being formed of more compact bony tissue.

Four notches, two above and two below, which are formed by the laminae being grooved out where they join the body. Each of these, with the corresponding notch above and below, forms a lateral hole, the *intervertebral foramen*, for the exit of the spinal nerves and the entrance of blood-vessels.

The foramen, a ring enclosed by the body and laminae, is called the spinal canal for the spinal cord, with its membranes and blood-vessels.

CHARACTERS OF THE CERVICAL VERTEBRÆ.

1st. *Their bodies* are small, deeper in front than behind, and long transversely. Their upper surfaces are concave from side to side, where they present two projecting lips. Their under surfaces are convex and rounded off at their sides.

2nd. *Their laminae* are long, broad, and thin.

3rd. *Their spinous processes* are short, horizontal, and bifid at their extremities.

4th. *Their transverse processes*, also short and bifid, are grooved upon their upper surface for the spinal nerves, and perforated by a round foramen at their bases for the vertebral artery, vein and plexus of nerves, the direction of which is upwards. Each transverse process has two roots; the posterior springs from between the articular processes,

at the junction of the pedicle with the arch, as is the case with the transverse process in the dorsal and lumbar regions; the anterior arises from the side of the body of the vertebra.

5th. *The articular processes* are large; their superior surfaces are oval, flat, and look upwards and backwards; their inferior surfaces, also oval and flat, look downwards and forwards.

6th. *The notches*, nearly of equal size, are small, and anterior to the articular processes, as in other vertebræ, but are behind the anterior roots of the transverse processes.

7th. *The vertebral foramen* is large and triangular.

DEVIATIONS.

The first, or atlas, consists of a large bony ring, enclosing an irregular foramen, which in the recent state is divided into two unequal segments by the transverse ligament; the anterior being occupied by the odontoid processes of the axis, the posterior by the spinal cord. Instead of a "body" it presents anteriorly a small arch of bone, the "anterior arch," marked by a tubercle in front, and a smooth oval surface behind, which articulates with the odontoid process of the axis. Laterally, the bone acquires great density and thickness, and forms the "lateral masses," which present upon their upper and lower aspects the articular processes, the

superior of which, horizontal, concave, and oval from before backwards, look upwards and inwards, and articulate with the condyles of the occipital bone; the inferior, flat and circular, look downwards and inwards and articulate with the second cervical vertebra. Internally each lateral mass is marked by a small tubercle which gives attachment to the transverse ligament. The transverse processes are long and terminate in a rounded extremity; they are pierced at their bases by the foramen for the vertebral artery, the direction of which is upwards and backwards; behind the superior articular surface is a groove, which marks the course of the vessel. The spinous process is represented by a small tubercle upon the middle of the posterior segment of the ring, which is considerably larger than the anterior.

The second, or axis, is distinguished by its large tooth-like or odontoid process, which rises from the upper surface of the body. This process presents anteriorly an oval surface for articulation with the ring of the atlas, and posteriorly a smooth surface which moves against the transverse ligament, whilst its apex or head presents an enlargement to which the check ligaments are attached. The laminae are very thick and strong, and terminate posteriorly in the spinous process, which is strong and bifid; the vertebral foramen is heart-shaped, the apex being posterior. The superior articular

surfaces are large, and slightly convex, and are directed upwards and outwards, whilst the inferior, looking downwards and forwards, are small and flat, and are situated behind the superior facets.

The transverse processes not bifid are short and directed downwards, the direction of the foramen for the vertebral artery being obliquely upwards and outwards: the superior notches are behind the superior articular processes, whilst the inferior notches are in front of the inferior processes as in other vertebræ.

The seventh cervical vertebra is called *vertebra prominens*, from the length of the spinous process, which projects backwards and terminates in a tubercle, to the extremity of which is attached the *ligamentum nuchæ*; the vertebral foramina, when they exist in the transverse processes, give passage occasionally to the vertebral veins; the transverse processes are often of such length as to resemble rudimentary ribs.

CHARACTERS OF THE DORSAL VERTEBRÆ.

1st. They are intermediate in size between the cervical and lumbar vertebræ.

2nd. *Their bodies* are thicker behind than in front, and more convex transversely, presenting upon their surfaces more a heart-shape than an oval form. On each side at the upper and lower

borders the body presents two small depressions or facets, the upper being the larger, which, with the intervertebral cartilage and the contiguous vertebræ, form depressions for the heads of the ribs.

3rd. *The laminæ* are broad and strong.

4th. *The spinous processes* are long, prismatic, tuberculated at their extremities and directed obliquely downwards, and overlap each other, especially from the fifth to the eighth vertebra.

5th. *The transverse processes*, thick and strong, are directed outwards and backwards; on the extremity and anterior aspect of each is an oval surface for articulation with the tubercle of the corresponding rib. On the posterior aspect of the transverse processes of the lower dorsal vertebræ are three indistinct tubercles, named from their situation, external, internal, and inferior tubercles.

6th. *The articular processes* are nearly vertical; the superior looking backwards and a little upwards and outwards, the inferior forwards and slightly downwards and inwards.

7th. *The vertebral foramen* is smaller than in the cervical or lumbar vertebræ and is nearly circular.

DEVIATIONS.

The 1st dorsal vertebra has an entire facet for the head of the first rib besides a demi-facet for the second; its body is longer transversely and

lipped on each side ; its spinous process is strong and horizontal, and its articular surfaces oblique. The 9th has only a demi-facet above. The 10th has an entire facet upon the body for the corresponding rib. The 11th and 12th have each an entire facet upon the body, and no articular facets upon their transverse processes, which are very short, and the 12th resembles a lumbar vertebra in the shape of its body, of its inferior articular processes, which are convex and turn outwards, and in the larger development of the tubercles at the extremities of the transverse processes.

CHARACTERS OF THE LUMBAR VERTEBRÆ.

1st. They are the *largest* of the three classes.

2nd. *The bodies* are very broad transversely, of oval form, deepened upon their upper and lower surfaces by a more compact lamina of bone, which, projecting beyond the bodies, renders them slightly concave from above downwards upon their forepart.

3rd. *The laminæ and spinous processes* are broad, thick, and short.

4th. *The transverse processes* are long, thin, and horizontal, and are regarded by some anatomists as abdominal ribs.

5th. *The superior articulating surfaces* are oval, concave, and look backwards and inwards ; the in-

ferior are oval and convex, directed outwards and forwards; and from each of the superior articular processes, which are wider apart than the inferior, there projects backwards the “tubercle.”

6th. *The vertebral foramen* is triangular and larger than in the dorsal vertebræ.

7th. *The notches*, particularly the inferior, are very large, and form larger foramina than in any other part of the spine.

DEVIATIONS.

The last lumbar vertebra has its body cut off obliquely upon its sacral aspect, so that it is much deeper in front than behind. Its transverse processes are long and rounded. The interval between the inferior articular processes equals that between the superior articular processes.

In examining the peculiar characters of the different vertebræ, it is best to select one from the centre of each class; thus the 3rd lumbar, the 6th or 7th dorsal, and the 4th or 5th cervical, afford the best examples of the class to which each belongs; for as the cervical vertebræ approach the dorsal, they begin to assume more or less the characters of the latter, and the last dorsal vertebra upon its under aspect presents the character of a lumbar vertebra. But there is no difficulty in determining the region to which any vertebra belongs,

however indistinctly its characters may be marked. Thus, the transverse processes of all the cervical vertebræ are perforated by a foramen, which transmits the vertebral artery and vein ; all the dorsal vertebræ present upon their bodies a smooth surface of articulation for the heads of the ribs ; all the lumbar vertebræ are distinguished by the absence of these characters.

Development of a vertebra. Each vertebra has three primary centres of ossification—one for the body and one for each lamina ; and five secondary centres—one for the spinous process, one for each transverse process, and one for each circular plate. In the lumbar vertebræ there are two additional centres, one for each tubercle upon the superior articular process. The *atlas* has three centres—one for the anterior arch and one for each lateral mass. The *axis* has six centres—one for the body, three for the odontoid process, and one for each lamina.

THE FIXED OR UNITED VERTEBRÆ.

Nine in number ; the five upper form the sacrum, the four lower the coccyx.

The Sacrum.

Shape, triangular with its base directed upwards, is formed by the coalescence of five vertebræ. The apex presents a small oval surface to articulate with the coccyx ; the base resembles a lumbar ver-

tebra and has projecting from each side an articular process for the last lumbar vertebra; laterally the base extends outwards and becomes continuous with the iliac fossa of the pelvis: the *lateral borders* present two surfaces: the superior, large and named from its shape the auricular surface, articulates with the ilium; the inferior thin, for the attachment of the sacro-sciatic ligaments.

Pelvic or anterior surface, smooth, concave from above downwards, is marked by four transverse lines and presents on each side of the median line four foramina, called *anterior sacral*, for the transmission of the anterior branches of the sacral nerves. The projection which the sacrum forms with the last lumbar vertebra is called "the promontory."

Dorsal or posterior surface, is irregularly convex, rough, presenting in the middle line an uneven ridge of coalesced spinous processes and more externally on each side tubercles of bone corresponding to the articular processes of the true vertebræ, from the lowest of which project two processes called the *sacral cornua*: on each side of the median line are the *posterior sacral foramina* for the transmission of the posterior divisions of the sacral nerves.

The sacral canal, triangular and large at the base, runs at the dorsal aspect of the bone, and terminates in a triangular fossa at its apex, where

it is bounded on each side by a tubercle which joins the cornua of the coccyx.

Development.—The sacrum is developed from thirty-five centres of ossification—three centres for the body of each segment, two for each lamina, six for the lateral masses, and two for each lateral surface of the sacrum.

The Coccyx.

Shape, triangular, the base articulating with the sacrum.

Anterior surface, smooth, marked by three transverse grooves indicating the junctions of the segments.

Posterior surface, rough, for the attachment of ligaments and muscles.

Cornua, are two, placed superiorly, which articulate with the sacral cornua.

The coccyx is usually composed of five, sometimes four, rudimentary vertebræ, of which the first, which articulates with the sacrum, is the largest.

Development.—By five or four centres, according to the number of its coalesced segments.

THE SPINE AS A WHOLE.

The average length of the spine is about twenty-seven inches, and viewed laterally it presents four curves : cervical, dorsal, lumbar, and pelvic. The

cervical and lumbar are convex anteriorly, the dorsal and the pelvic are concave; the lumbar and the pelvic curves exceed the cervical and the dorsal, respectively. In the dorsal region moreover there is a lateral inclination to the right side, usually ascribed as the result of increased muscular action of that side.

Form.—The front aspect of the spine formed by the bodies is seen to increase in breadth from the axis to the first dorsal vertebra; at this point it narrows as far as the fourth dorsal, and then gradually increases to the base of the sacrum. In the lateral view the bodies are seen to increase gradually from the axis to the fifth lumbar. Posteriorly, the spinous processes are arranged in a linear series, with the usual inclination of some of the dorsal spines to the right side. On each side of these is the vertebral groove, shallow in the cervical and lumbar regions, deeper and broader in the dorsal, and lodge in the recent state the deep muscles of the back. External to the groove are situated the articular processes, and in front of these are the transverse processes.

THE THORAX

Is formed by the dorsal vertebræ posteriorly, the ribs and costal cartilages laterally, and the sternum anteriorly.

The Ribs,

Twelve in number, are divided into *seven true* and *five false*; the two lowest of the false being free in front, are called *abdominal* or *floating ribs*.

The true ribs or *vertebro-sternal* are connected with the sternum by separate cartilages.

The three superior false ribs have their cartilages attached to each other and to the cartilage of the seventh.

The false or *floating ribs* have their cartilages free.

Common Characters of a Rib.

The head, round, and divided by a transverse ridge into two articular surfaces, the lower of which is the larger. These are received into the depressions on the sides of the bodies of the dorsal vertebræ, the ridge affording attachment to the inter-articular ligament which connects the ribs to the inter-vertebral fibro-cartilage.

The neck, narrow and round; at its junction with the shaft is

The tubercle, a prominence of bone, with a smooth surface looking backwards to articulate with a transverse process of the vertebræ beneath, and external to this, a rough surface for the attachment of the posterior costo-transverse ligament.

The shaft is that portion of the rib which extends

from the tubercle to its sternal end, and presents an external smooth convex surface and an internal concave one. At the point where the rib makes its sudden curve is a rough line which is called *the angle*. The upper border of the shaft is round and smooth, its lower border thin and grooved for the intercostal vessels, and its sternal extremity presents an oval depression for the reception of the costal cartilage.

Development.—From three centres ; one each for the shaft, tubercle, and head. The last two ribs have only two, one for the shaft and one for the head.

DEVIATIONS.

The First Rib

Is broad and flat and placed horizontally ; its head is small and articulating with only one vertebra, has no ridge, and a single articular facet. The neck is narrow and round ; the tubercle very thick and prominent. It has no angle and its sternal extremity is thick and strong ; one surface looks upwards, the other downwards ; the superior presents a tubercle for the attachment of the scalenus anticus, which separates two grooves—the anterior for the subclavian vein, the posterior for the subclavian artery. Behind the posterior groove is a rough surface for the attachment of the scalenus medius. The under surface is smooth.

The Second Rib,

Longer than the first, presents externally an oblique prominent ridge for the attachment of part of the first and the second digitation of the serratus magnus muscle. Its angle is slight, and it has a slight groove on the inner aspect posteriorly.

The Tenth Rib

Has only one articular facet on its head.

The Eleventh and Twelfth Ribs

Are very short, have neither angle, tubercle, nor groove, and the head has a single articular facet.

THE STERNUM.

Shape, flat, elongated, broader above than below, narrower in the centre, and is composed originally of six segments; in the adult it consists of three portions—an upper or manubrium; a middle, the gladiolus; and an inferior, the ensiform cartilage.

Anterior surface is rather convex, and is marked by four transverse lines.

Posterior surface, smooth and concave.

Upper piece or manubrium, quadrilateral and thick, is concave from side to side upon its upper border, and presents at each superior angle two

semilunar depressions for articulation with the clavicles; its lower border is straight and is united to the second piece; its lateral borders receive on each side the cartilage of the first rib and half that of the second.

Second piece or gladiolus, long, narrow, and marked by three transverse lines; receives, by five depressions upon its lateral borders, the cartilages of the five inferior true ribs, and by a notch at its superior angle half the cartilage of the second rib: its inferior is thin and terminates in a cartilaginous prolongation called the

Ensiform cartilage, which is sometimes bifid and pierced by a foramen, its direction being variable.

Development.—By six centres—one for the manubrium, four for the gladiolus, and one for the ensiform cartilage.

THE PELVIS

Is formed of the sacrum, coccyx (both of which bones have been already described), and the two ossa innominata.

OS INNOMINATUM,

Consists in early life of three parts, the ilium, the ischium, and the pubes. These become blended at puberty so as to form a single bone. Each of these parts will be described separately.

THE ILIUM

Is the upper broad expanded portion of the bone. Is bounded above by a curved border, the *crest of the ilium*: it terminates anteriorly in a projection, the *anterior superior spine*; posteriorly in an eminence, the *posterior superior spine*. The crest is divided into an external and internal lip and an intermediate space. Below the anterior superior spine and separated from it by a concave border is the *anterior inferior spine*; below the posterior superior spine and separated from it by a small notch is the *posterior inferior spine*.

The *ala* presents two surfaces; the outer or *dorsum* is concavo-convex and is crossed by three semicircular lines, of which the superior passes from the crest about two inches from the posterior superior spine to the sacro-sciatic notch, where it becomes much fainter; the middle, the longest, begins about an inch behind the anterior superior spine, and curves downwards and backwards to the great sacro-sciatic notch; and the inferior curves towards the lower part of the same notch. The gluteus maximus arises from the rough surface above the superior curved line, the gluteus medius from the space between this and middle line, and the gluteus minimus between the middle and inferior lines. In the centre is the foramen for the nutrient artery. The inner surface or *venter* pre-

sents anteriorly a fossa, the iliac fossa, posteriorly an uneven surface for articulation with the side of the sacrum. The upper portion of this articulation is rough and gives attachment to the posterior sacro-iliac ligament; the lower, called the auricular surface, is smooth and covered with cartilage.

THE PUBES

Forms the anterior part of the os innominatum, and the internal part of acetabulum; is divided into a body, an horizontal and descending ramus.

Body, is the portion between the rami; the upper border, called the crest, terminates externally in the *spine* and internally in the *angle*; the front surface is rough for attachment of muscles; the posterior, smooth, looks towards the pelvis; the inner border forms, with its fellow, the *symphysis pubis*. The *descending ramus* passes obliquely downwards and outwards from the body to join the ramus of the ischium. The *horizontal ramus* passes outwards to form part of the acetabulum; its upper surface, triangular, is bounded behind by a ridge, the *pectineal line*, which passes from the spine to form part of the linea ilio-pectinea.

The *obturator groove* for the obturator vessels and nerve, is situated upon the under surface of the horizontal ramus.

The *obturator* or *thyroid foramen* is the oval

opening bounded above by the pubes, below by the ischium.

THE ISCHIUM

Forms the lower, outer, and back part of the os innominatum.

Body, forms the outer and back part of the acetabulum ; immediately below this cavity is a transverse groove for the tendon of the obturator externus muscle. The anterior free border of the body assists to form the obturator foramen, the posterior to form the lesser sciatic notch.

Spine, projects from posterior part of body, and gives attachment to the lesser sacro-sciatic ligament.

Tuberosity, the thickest part of the bone, on which the body rests when sitting, gives attachment to the greater sacro-sciatic ligament. Between this process and the spine is a shallow groove for the tendon of the obturator internus muscle.

Ascending ramus, turns upwards, forwards, and inwards, and joins the descending ramus of the pubes; it bounds the obturator foramen by its thin border, and the lower opening of the pelvis by its thick one.

THE ACETABULUM

Is a cup-shaped cavity on the outer aspect of the bone; is formed by the junction of the ilium,

ischium, and pubes—the ilium forming rather less than two-fifths, the ischium rather more than two-fifths, and the pubes the remaining fifth. It is bounded by a broad articular rim for the head of the femur, below a depression for a mass of fat, containing blood-vessels for the supply of the synovial membrane. It is surrounded in the greater part of its circumference, by a margin, which is prominent at the upper and lower part, but deficient at the lower and inner part, towards the obturator foramen. The part where the margin is wanting is called the cotyloid notch, and is bridged over by the transverse ligament; to the borders of the notch is attached the ligamentum teres.

Differences between the male and female pelvis: The male pelvis is heavier, the iliac crests less expanded, the depressions for muscles better marked, the obturator foramen larger, the inlet and outlet of the pelvis smaller, the pubic arch more pointed, the tuberosities of the ischia and acetabula less wide apart, the sacrum narrower and more curved, and the coccyx more fixed.

The pelvis is divided by the linea ilia pectinea into the *false* and *true* pelvis. The false is that part above the line, the true that below it. The upper part of the true pelvis is called the *brim* or *inlet*, and has three principal diameters, antero-posterior, transverse, and oblique. Of these the transverse is the longest, its average being five

inches. The lower part of the true pelvis is termed the *outlet*, and has two diameters, the antero-posterior and transverse. The former extends from the coccyx to the symphysis pubis, the latter between the two ischiatic tuberosities.

The average diameter of these is four inches.

Development.—By eight centres—three primary (one each for the ilium, ischium, and pubes) and five secondary ones (one each for the crest of the ilium, the symphysis pubis, the tuberosity of the ischium, the anterior superior spine of the ilium, and the bottom of the acetabulum).

THE UPPER EXTREMITY

Consists of the shoulder, the arm, forearm and hand.

THE BONES OF THE SHOULDER

Are the clavicle and the scapula.

THE CLAVICLE

Is placed horizontally between the sternum and the acromion process of the scapula, and is curved like the italic *f*.

Sternal end, thick, presenting a concavo-convex, triangular, articular surface; its edge is rough for ligaments.

Body, cylindrical towards sternum, flat and ex-

panded towards its acromial end. In front its inner curve is convex, its outer curve concave. Upon its under surface are, 1, towards the sternal extremity a rough surface for the costo-clavicular ligament; 2, towards the acromial extremity, a rough oblique line for the coraco-clavicular ligaments, and between both a groove for the subclavius muscle, in which groove is situated the nutrient foramen.

Acromial end, rough and flattened, passes over the coracoid process to join the acromion, with which it articulates by a small oval flattened surface.

Development.—By two centres, one for the shaft and one for the sternal end.

THE SCAPULA,

Situated on the upper and back part of the thorax, extending from the second to the seventh ribs, inclusive.

It is triangular in shape, and has two surfaces, three borders, and three angles.

Costæ or borders.—The superior or cervical is the shortest and presents on its extremity a notch for the supra-scapular nerve; the external or axillary border next in size is the thickest, and has a rough ridge for the triceps muscle; below this is a groove for the dorsalis scapulæ artery; the

posterior or vertebral is the longest, and is also called the base of the scapula.

Angles.—The superior angle is acute and prominent, the inferior is rounded and thicker, and the anterior is the thickest and forms the glenoid cavity, which is connected to the body by a thin process, the neck.

Anterior surface or ventor or subscapular fossa, is slightly concave and divided by three or four lines which run from above obliquely downwards and inwards.

Posterior or dorsal surface, is divided by the spine into two unequal fossæ—the upper, the smaller, the supra-spinous ; the lower, the infra-spinous fossa.

Spine, arises by a small triangular, flat surface at the vertebral border and passes forward, becoming more prominent and terminates in the acromion, which surmounts the shoulder-joint and articulates with the acromial end of the clavicle by a small oval surface.

Supra-spinous fossa, situated above the spine, is deep, and presents a nutrient foramen ; it gives origin to the supra-spinatus muscle.

Infra-spinous fossa, larger, irregularly concave-convex, gives origin to the infra-spinatus muscle, the teres minor muscle, and by an inferior rough surface to the teres major muscle.

Coracoid process, overhangs the inner and upper

part of the glenoid cavity. This process has a crooked direction, and gives origin to the common tendon of the coraco-brachialis and biceps; to the insertion of the pectoralis minor, and attachment to ligaments.

Glenoid cavity, articulates with the head of the humerus, is pyriform and shallow, broader below, and affords origin at its upper narrow part to the long head of the biceps.

Neck, is the contracted portion of the scapula behind the glenoid cavity; it affords attachment to the glenoid ligament.

Development.—By seven centres—one for the body, two each for the coracoid and acromial processes, one for the posterior border, and one for the inferior angle.

THE HUMERUS,

Articulates with the scapula above, and ulna and radius below; it is divisible into a shaft and two extremities.

Head, forms about $\frac{1}{3}$ of a sphere, is smooth, and covered with cartilage in the recent state. Its direction is obliquely backwards, upwards and inwards to the glenoid cavity of the scapula.

Neck, is the slightly constricted base of the head for the attachment of the capsular ligament. It is united to the shaft at an obtuse angle.

Two tuberosities are situated at the top of the

shaft. They are separated by a groove, the bicipital. The *greater* is external, and affords insertions by three flat surfaces to the supra-spinatus, infra-spinatus, and teres minor muscles; the *lesser* is more internal and gives insertion to the subscapularis muscle.

Bicipital groove, is situated between the tuberosities, lodges the long tendon of the biceps, and gives insertion by anterior margin to the pectoralis major and by its posterior margin to the latissimus dorsi and teres major muscles.

Shaft, is rather twisted, the upper extremity cylindrical, the lower flattened; two longitudinal ridges, arising one from the outer the other from the inner condyle, afford attachment to intermuscular septa, and divide the bone into an anterior and posterior surface. The outer condyloid ridge is interrupted by an oblique groove which lodges the musculo-spiral nerve and superior profunda artery; upon the external and central aspect is a triangular rough surface for insertion of the deltoid muscle, and upon the inner side of the centre is a rough line for the insertion of the coracobrachialis muscle. The posterior surface gives origin to second and third heads of the triceps. The nutrient foramen is directed towards the joint.

Internal condyle is prominent and sharp, affording attachment to the pronator radii teres and flexor muscles and the internal lateral ligament.

External condyle, less prominent, but descends nearer to the joint, gives origin to the anconeus, the extensor muscles, to the supinator brevis, and to the external lateral ligament.

The inferior articulating surface presents externally a small round *head* or *capitellum*, situated nearer the anterior than the posterior part of the bone, for the radius. Internally the *trochlea* or pulley-like surface for the ulna, which extends round to the posterior aspect of the bone.

Coronoid fossa, in front of the bone above the trochlea, and receives the coronoid process of the ulna when flexed.

Olecranon fossa, at the back of the bone above the trochlea, and receives the olecranon process of the ulna when extended.

Development.—From seven centres—one each for the head, greater tuberosity, shaft, external condyle, capitellum, trochlea, and internal condyle.

THE ULNA

Is placed on the inner side of the forearm, and is longer and stronger than the radius.

Upper extremity articulates with the humerus and radius.

Olecranon process forms the projection of the elbow, is the highest part of the bone, and by its upper surface gives insertion to the triceps.

muscle ; posterior to this it is smooth for a bursa mucosa.

Coronoid process, anterior and inferior to the olecranon, is smaller than it, and has below a triangular rough surface for the insertion of the brachialis anticus muscle ; on the inner aspect there are two eminences, one for the second head of the pronator radii teres, the other for the flexor sublimis digitorum ; to the free border of this process is attached the internal lateral ligament.

Greater sigmoid cavity has its long axis from before backwards, is divided in the centre by a ridge into two lateral portions, and receives the trochlea of the humerus. It is bounded above by the olecranon, below by the coronoid process.

Lesser sigmoid cavity, on the outer side of the coronoid process, is concave and oval, and receives the side of the head of the radius.

Shaft presents three surfaces and three borders ; the anterior surface gives origin above to the flexor profundus digitorum ; below to the pronator quadratus, and is pierced by the nutrient foramen which is directed upwards ; the posterior surface gives insertion to the anconeus, and origin to the supinator brevis and extensor muscles of the thumb and index finger ; the internal gives origin to the flexor profundus digitorum ; below it is subcutaneous. Of the borders, that directed towards the radius is the best marked ; it gives attachment to the inter-

osseous membrane. The upper three-fourths of the posterior border is well marked, and serves for the attachment of an aponeurosis common to the origins of the flexor carpi ulnaris, extensor carpi ulnaris, and the flexor profundus digitorum.

Carpal extremity, slender and rounded, presents the *head*, which by its side articulates with the radius, and by its carpal aspect with the fibrocartilage of the wrist joint; also the *styloid process* at its inner margin, which by its apex gives attachment to the internal lateral ligament of the carpus, and by a depression at its root, to the fibrocartilage; posteriorly it presents a groove for the tendon of the extensor carpi ulnaris muscle.

Development.—By three centres—one for the olecranon, one for the shaft, and one for the lower extremity.

THE RADIUS

Is situated external to the ulna, and is shorter than that bone by the length of the olecranon.

Head, a circular cavity with a smooth vertical border, articulates above with the capitellum of the humerus, and laterally with the lesser sigmoid cavity of the ulna.

Neck, about an inch in length, narrow and rounded, and terminating in the

Tubercle, a prominent process, into the posterior part of which is inserted the biceps muscle.

Shaft, triangular and somewhat curved ; by its anterior surface it affords origin to the flexor longus pollicis, and insertion to the pronator quadratus muscles ; by its posterior convex surface to the supinator radii brevis and extensor muscles of the thumb ; its external surface is round and convex, and rough near its centre for the insertion of the pronator radii teres ; leading from the tubercle to the outer surface is an oblique ridge which gives origin to the flexor sublimis digitorum. The inner border is sharp for the attachment of the inter-osseous membrane, and the foramen for the nutrient artery is upon the anterior surface and directed upwards.

Carpal extremity, expanded and quadrilateral, gives attachment by its anterior border to the anterior carpal ligament ; on its posterior aspect it is marked by a number of grooves : the most external one lodges the extensores ossis metacarpi pollicis and primi internodii pollicis ; the second, the extensores carpi radialis longior and brevior ; the third, narrow and oblique, the extensor secundi internodii pollicis ; the fourth, the extensor communis digitorum and indicator ; and the groove between the radius and ulna gives passage to the extensor minimi digiti.

Styloid process, prolonged on the outer side of the bone downwards, gives attachment by its apex to the external lateral ligament ; to its base is inserted the supinator radii longus.

Sigmoid cavity, on the inner border of the carpal extremity for articulation with the ulna.

Carpal aspect presents two concave, articular facets, divided by a slight ridge; the external being triangular for articulation with the os scaphoides, the internal quadrilateral for the os lunare.

Development.—One for the shaft and one for each extremity.

THE CARPUS

Consists of two rows of small bones, four bones in each row, placed between the forearm and metacarpus. It is convex and rough upon its dorsal aspect and concave upon its palmar aspect, where the vessels, nerves, and tendons of the flexor muscles are situated; towards the radius and inter-articular cartilage of the wrist it is convex; towards the metacarpus it presents articular surfaces for the metacarpal bones. Each carpal bone has one centre of ossification.

FIRST ROW.

Os Scaphoides.

Situation, on outer and upper part of the carpus, next the styloid process of the radius.

Articulations, with the radius above, with the trapezium and trapezoides below, and with the lunare and magnum internally.

Os Lunare.

Situation, between the scaphoides and cuneiforme. The surface which articulates with the first metacarpal bone is concave in one direction, convex in the other.

Os Trapezoides.

Situation, between the trapezium, magnum, scaphoides, and metacarpal bone of the index finger.

Articulations, with the scaphoides above, the trapezium externally, the magnum internally, and below with the metacarpal bone of the index finger.

Os Magnum.

Processes, head, neck, and body.

Situation, between the scaphoides and lunare, and the second, third, and fourth metacarpal bones.

Articulations, by its head with the scaphoides and lunare, by its base with the second, third, and fourth metacarpal bones; externally with the trapezoides, and internally with the unciforme.

Os Unciforme.

Situation, between the cuneiforme and metacarpal bones of the ring and little fingers.

Articulations, with the lunare above, the magnum externally, the cuneiforme internally, and below with the fourth and fifth metacarpal bones.

Process, a hook-like process upon its palmar aspect.

THE FINGERS.

The fingers are composed of three phalanges, except the thumb, which has only two.

The first phalanges are five in number, their bases presenting oval concavities for the heads of the metacarpal bones; their anterior extremities are convex from before backwards, and concave from side to side, to articulate with the second phalanges.

The middle, or second phalanges, are four in number, and smaller than the first; their bases present pulley-like surfaces, to form a ginglymoid joint with the first phalanges, and at their anterior extremities resemble the first.

The unguis, or third phalanges, are five in number, and the smallest. By their bases they form a ginglymoid joint with the middle phalanges; and their extremities are convex upon their dorsal aspects for the support of the nail, whilst their palmar aspects are irregularly tuberculated for the extremities of the fingers.

The sesamoid bones are sometimes absent. In general two are to be found between the metacarpal bone of the thumb and its first phalanx, and one or two at the corresponding joint of the index finger.

Each phalanx has two centres of ossification, one for the base, and one for the shaft.

THE LOWER EXTREMITY.

The bones proper to the lower extremity are the femur, the tibia, the fibula, the patella, seven tarsal bones, five metatarsal bones, and fourteen phalanges.

FEMUR.

Head, forms nearly two-thirds of a sphere, and articulates with the acetabulum, being directed forwards, upwards, and inwards; below and behind its centre is a rough depression for the ligamentum teres; its junction with the neck is marked by a rough line. With the exception of these parts the head is covered by cartilage in the recent state.

Neck, extends obliquely downwards, outwards, and forwards, and connects the head with the shaft, which it joins at an obtuse angle; it is flattened from before backwards, and its lower border is much longer than its upper. The obliquity of the neck to the shaft varies at different periods of life, forming in children a gentle curve from the axis of the shaft, while in old subjects the neck forms nearly a right angle with the shaft.

Great trochanter, is continued upwards from the shaft, but does not extend as high as the head; is situated externally, and gives attachment to the

gluteus medius, gluteus minimus, pyriformis, obturator internus and two gemelli, quadratus femoris, and part of the vastus externus. Over its outer surface plays the flat tendon of the gluteus maximus.

Digital, or trochanteric fossa, is situated at the root of the great trochanter, and affords insertion to the obturator externus.

Lesser trochanter, is placed posterior and internal to the shaft, and has inserted into it the tendon of the psoas magnus, and the surface immediately below affords insertion to the iliacus muscle. Between the tendon and the bone is a bursa.

Inter-trochanteric lines, are two in number, one anterior, and the other posterior, the latter being the more prominent; as their name implies, they pass obliquely from one trochanter to the other.

Shaft, is broad at each extremity, particularly towards the knee, and is narrow and triangular in the centre; it is arched and smooth anteriorly, where it gives origin to the crureus and subcrureus muscles; the posterior aspect is concave, and presents a prominent ridge called the linea aspera. The foramen for the nutrient artery is situated on this aspect about the middle of the bone, and is directed upwards.

Linea aspera, for the attachment of muscles, is a prominent ridge, extending along the central third of the back of the shaft; towards the up-

per third it bifurcates, one ridge running towards each trochanter; inferiorly it also divides into two ridges, which pass to each condyle, the inner one being interrupted where the popliteal vessels pass over it. Between these inferior ridges there is a flat, triangular surface, which forms part of the popliteal space.

External condyle, projects more upon the anterior surface of the femur than the internal; its articular surface is broader and ascends higher upon the shaft; upon its outer surface it presents a narrow groove for the origin of the popliteus: to the posterior part of the inner surface is attached the anterior crucial ligament.

Internal condyle, more prominent, longer, and narrower than the external; and it descends lower in order that both condyles should rest upon the tibia in the natural oblique direction of the femur. It presents on its inner side, and behind a depression for the gastrocnemius: the outer side gives attachment anteriorly to the posterior crucial ligament.

External tuberosity, above the external condyle, for the attachment of the external lateral ligament of the knee-joint.

Internal tuberosity, above the external condyle, and more prominent than the external, for the internal lateral ligaments and the insertion of the adductor magnus tendon.

Trochlea, between the condyles on their anterior aspect, supports the patella when the leg is extended.

Inter-condyloid notch, is situated posteriorly between the condyles.

Development.—By five centres; one for shaft and neck, one for each extremity, and one for each trochanter.

PATELLA,

Is a sesamoid bone, triangular, the base superiorly having the common extensor tendon inserted into it, the apex below, to which is attached the ligamentum patellæ.

Anterior surface, is convex, and presents a fibrous appearance.

Posterior surface, presents two articular surfaces, divided by a prominent ridge; the internal surface is the deeper, while the external is broad, and shallow. The inner border is sharper and more prominent than the outer.

Development.—By one centre.

TIBIA.

Upper extremity, articulates with the femur, and is expanded from side to side to form two articular surfaces which support the condyles of the femur. These surfaces are oval and concave, of which the inner is the deeper and longer. Between them

is the spine, a bifid extremity, in front of and behind which are depressions for the attachment of the crucial ligaments and the semilunar cartilages. On each side of the upper extremity is a rounded prominence, the external and internal tuberosities. On the outer one is a flat articular surface for the fibula, on the inner a groove for the insertion of the semi-membranosus muscle. Anteriorly it is convex and has a tubercle for the attachment of the ligamentum patellæ; posteriorly it is slightly hollowed.

Shaft, triangular, presenting three surfaces separated by corresponding borders. The inner surface is convex and subcutaneous, except at its upper part, where the tendons of the sartorius, gracilis, and semi-tendinosus pass over it; it terminates below in the inner malleolus; the outer surface is covered by the tibialis anticus muscle for its upper two-thirds and is here concave; inferiorly the bone is flattened to support the tendons of the extensor tendons of the toes; the posterior surface presents an oblique ridge directed upwards and outwards for the origin of the soleus, above this a triangular flat surface for the insertion of the popliteus, and below the ridge the bone gives origin to the flexor longus digitorum, and the tibialis posticus; the nutrient foramen, which is the largest in the body, is a little below this ridge, and directed downwards. Of the borders the anterior is most

prominent and subcutaneous ; the inner is less defined, and the outer is well marked, giving attachment to the interosseous membrane.

Lower extremity, is much smaller than the upper and quadrilateral, the anterior edge being convex for the passage of the extensor tendons ; the posterior, marked by a groove, for the passage of the tendon of the flexor longus pollicis muscle ; the external presenting a rough, triangular depression for the fibula, and the internal terminating in the internal malleolus.

Internal malleolus, is convex and subcutaneous internally ; its articular aspect is smooth to articulate with the astragalus ; it gives attachment by its inferior border to the internal lateral ligament of the ankle-joint, and is grooved posteriorly for the tendons of the tibialis posticus and the flexor longus digitorum muscles.

Inferior articular surface, rests upon the upper surface of the astragalus ; it is quadrilateral and concave from before backwards, and joins the smaller articular surface of the internal malleolus at a right angle.

Development.—By three centres, one for the shaft and one for each extremity.

FIBULA.

Situation, on the outer side of the tibia.

Upper extremity, or head, articulates with the tibia by a small circular surface directed upwards and inwards, and affords attachment to the external lateral ligament of the knee-joint and the biceps muscle by a single projection, called the styloid process.

Neck, is the small constricted part by which the head is united to the shaft.

Shaft, triangular and twisted, gives origin to the peronei muscles by its external surface to the soleus, tibialis posticus, and flexor longus pollicis by its posterior surface, to the extensor longus digitorum, peroneus tertius, and extensor proprius pollicis by its anterior surface. Its inner edge is well defined, to afford attachment to the interosseous membrane; and the nutrient foramen, directed downwards, is placed upon the posterior aspect of the bone.

Tarsal extremity, presents a large oval process called the external malleolus, about two inches and a half above which the shaft is constricted.

External malleolus, is larger, longer, and more prominent than the internal, on a line posterior to which it is situated; by its edge it affords attachments to the external lateral ligament of the ankle-joint. Its outer surface is convex and subcutaneous; the inner or articular is triangular and smooth to articulate with the outer side of the astragalus, to the side of which is a rough depres-

sion; the posterior border presents a groove for the passage of the tendons of the peronei muscles.

Development.—By three centres, one for the shaft and one for each extremity.

THE TARSUS,

Forms the posterior part of the foot; the bones which compose it are seven in number, and articulate with one another. It is connected above to the tibia and fibula, below it is arched, and anteriorly it articulates with the bases of the five metatarsal bones. The seven tarsal bones are the calcaneum, astragalus, scaphoid, cuboid, and three cuneiform bones.

CALCANEUM, OR OS CALCIS.

Situation, at the posterior and under part of the tarsus.

Posterior aspect, elongated to form the heel, presents a smooth surface above for a bursa, and a rough surface below for the insertion of the tendo-Achillis, and plantaris.

Anterior aspect, articulates by a triangular concavo-convex surface with the cuboid bone.

Superior aspect, presents two articular facets to support the astragalus: the posterior convex; the anterior, oblong and concave, is situated on the upper aspect of the sustentaculum tali. They are

separated by a long groove for the attachment of the interosseous ligament.

Inferior aspect, is irregular, and presents two tubercles, the internal of which is the more prominent ; they afford origin to muscles.

External aspect, presents posteriorly a small tubercle for the attachment of the middle fasciculus of the external lateral ligament. In front is a ridge, the peroneal tubercle, above which passes the peroneus brevis and below the peroneus longus.

Internal aspect, is deeply concave for the lodgment of the plantar vessels and nerves and the flexor tendons ; bounding the concavity above is a process of bone, the lesser process, or sustentaculum tali, to the border of which is attached the internal lateral ligament.

It articulates with two bones, the astragalus and the cuboid.

ASTRAGALUS.

Situation, at the upper and middle part of the tarsus, between the malleoli ; the tibia above and the os calcis below.

Superior aspect, presents a smooth articular surface, convex from before backwards, broader in front than behind, and articulates with the tibia.

Inferior aspect, presents two articular surfaces for the os calcis, which are separated by a groove for the interosseous ligament.

Posterior aspect, is narrow, and presents a groove for the flexor longus pollicis, and a pointed eminence for the posterior fasciculus of the external lateral ligament.

Anterior aspect, convex and smooth, forms the head, which is directed forwards and inwards, and is larger than the concavity of the scaphoid bone, with which it articulates. Between the head and the bone is a narrow constriction—the *neck*.

External aspect, presents a triangular concave surface for articulation with the external malleolus.

Internal aspect, presents a pyriform surface for articulation with the internal malleolus.

It articulates with the tibia, fibula, os calcis, and scaphoid.

SCAPHOIDES.

Situation, middle of the tarsus.

Superior and inferior aspects, rough, for the attachment of ligaments.

External and internal aspects, for the attachment of ligaments; the internal also presents a *tubercle* for the insertion of the tendon of the tibialis posterior.

Posterior aspect, is smooth and concave, broader externally, for articulation with the head of the astragalus.

Anterior aspect, presents two vertical lines, which divide it into three smooth surfaces for articulation

with the cuneiform bones, and in general a small articular facet externally, for articulation with the cuboid bone.

It articulates with the astragalus, three cuneiform bones, and occasionally with the cuboid bone.

CUBOIDES.

Situation, outer and anterior part of the tarsus.

Superior aspect, flat and rough, for attachment of ligaments.

Inferior aspect, tuberculated behind for the calcaneo-cuboid ligament, and presenting a groove anteriorly for the tendon of the peroneus longus muscle.

Posterior aspect, smooth, concave and triangular, to articulate with the os calcis.

Anterior aspect, presents two articular facets; the external, triangular, articulates with the fifth metatarsal bone; the internal, quadrilateral, for the fourth metatarsal bone.

External aspect, free, and is marked by the commencement of the peroneal groove.

Internal surface presents anteriorly an oval facet for articulation with the external cuneiform bone, and occasionally posteriorly one for the scaphoid bone.

It articulates with os calcis, external cuneiform bone, fourth and fifth metatarsal bones, and occasionally with the scaphoid.

INTERNAL CUNEIFORM BONE,

The largest of the three, articulates behind with the scaphoid; in front with the first metatarsal bone; externally with the middle cuneiform and side of the second metatarsal bone; on the internal aspect there is a smooth surface for the play of the tendon of the tibialis anticus muscle.

Tubercle, is situated inferiorly for the insertion of the tendon of the tibialis anticus muscle, and part of the tendon of the tibialis posticus. It articulates with the scaphoid, middle cuneiform and first and second metatarsal bones.

MIDDLE CUNEIFORM BONE,

The smallest, articulates behind with the scaphoid; in front with the second metatarsal bone; internally with the internal cuneiform and externally with the external cuneiform.

EXTERNAL CUNEIFORM BONE,

Articulates behind with the scaphoid; in front with the third metatarsal bone; internally with the middle cuneiform and side of the second metatarsal bone; and externally with the cuboid and fourth metatarsal bone.

Each tarsal bone has one centre of ossification, except the os calcis, which has two.

THE METATARSUS,

Is the middle part of the foot, and is composed of five long bones placed between the tarsus and the toes.

FIRST METATARSAL BONE,

The shortest and thickest, is convex above and concave below.

Posterior extremity, is smooth and kidney-shaped to articulate with the internal cuneiform bone.

Anterior extremity, round, to articulate with the first phalanx of the great toe. The under surface of this extremity articulates with two sesamoid bones, and receives the insertion of the tendon of the peroneus longus.

SECOND METATARSAL BONE,

The longest.

Posterior extremity, articulates with the three cuneiform bones, and also with the metatarsal bone.

Anterior extremity, presents a round head, for articulation with the second toe; it is separated from the shaft of the bone by a groove.

THIRD METATARSAL BONE.

Posterior extremity, articulates with the third cuneiform bone.

Anterior extremity, resembles the second, and articulates with the third toe.

FOURTH METATARSAL BONE.

Posterior extremity, articulates with the cuboid bone, and by its inner side with the third cuneiform.

Anterior extremity, resembles the second, and articulates with the fourth toe.

FIFTH METATARSAL BONE.

Posterior extremity, articulates with the cuboid bone, by a surface directed obliquely upwards and outwards.

Anterior extremity, resembles the second, and articulates with the fifth toe.

PHALANGES, OR TOES,

Are composed of fourteen bones, three to each toe, except the first, which has only two.

FIRST PHALANGES.

Shape, convex above, concave below, and the longest.

Anterior extremities, convex from above downwards, and concave laterally; form ginglymoid articulations with the second phalanges.

Posterior extremities, are large, and present rounded concavities for the heads of the metatarsal bones.

SECOND PHALANGES.

Anterior extremities, resembles those of the first phalanges.

Posterior extremities, concave from above downwards, and convex transversely, articulate with the first phalanges.

THIRD PHALANGES.

Anterior extremities, pyramidal in form, support the nails on their upper surface, and are rough on the under surface.

Posterior extremities, resemble the posterior extremities of the middle phalanges.

SESAMOID BONES,

Are uncertain in development; two are generally found at the base of the first phalanx of the great toe and one at that of the fifth toe. They are also frequently developed in the tendons which cross the sole of the foot in those situations where they are subjected to much pressure.

THE SKULL

Consists of two parts, the cranium and the face : the former is composed of eight bones, the occipital, two parietal, frontal, ethmoid, sphenoid, and two temporal ; the face, of fourteen bones, two malar, two nasal, two superior maxillary, two lachrymal, two palate, two inferior turbinated bones, the vomer and the inferior maxilla.

OCCIPITAL BONE.

Situation, posterior and inferior part of cranium.

Posterior surface, is convex, and presents the *external occipital protuberance* about its centre ; passing from the protuberance to the foramen magnum is a ridge, the *crest* which affords attachment to the ligamentum nuchæ. Arching outwards are two parallel transverse lines, the *superior* and *inferior curved lines*.

Foramen magnum, larger internally than externally, is of oval form, and transmits the medulla oblongata and its membranes, the vertebral arteries, and spinal accessory nerves.

Condyles, two in number, smooth, convex, and oblong, look downwards, outwards and backwards ; they converge anteriorly, and on their inner aspects are two tubercles for the check ligaments.

Anterior condyloid foramina, placed in front of

the condyles for the passage of the hypoglossal nerves : sometimes divided into two.

Posterior condyloid foramina, behind the condyles for the passage of veins to the lateral sinus. They are sometimes absent.

Jugular eminences, external to each condyle ; each forms, with the temporal bone, the foramen lacerum posterius.

Internal surface, is concave, and is divided into four fossæ by a crucial ridge ; the two superior are for the posterior cerebral lobes, the two inferior for the lobes of the cerebellum. The upper half of the vertical line gives attachment to the falx cerebri, the lower half to the falx cerebelli ; the transverse ridge gives attachment to the tentorium cerebelli, and also presents a groove for the lateral sinus. At the junction of the vertical with the transverse ridge is the internal occipital protuberance, where six sinuses meet at the torcular Herophili—viz., the superior longitudinal, the straight, the two lateral and the two occipital.

Groove for the termination of the lateral sinus, on each side of the foramen magnum above the jugular eminence.

Basilar process, passes forwards and upwards to join the sphenoid bone, is rough inferiorly for the attachment of the recti capitis antici major and minor muscles, and the fibrous band of the pharynx ; and upon its cerebral aspect, is smooth and concave

from side to side to support the pons Varolii and basilar artery, and marked laterally by two superficial grooves, which lodge the inferior petrosal sinuses. It articulates with six bones—viz., the two parietal, the two temporal, the sphenoid, and the atlas.

Development.—By four centres; one for the tabular portion which is formed in membrane, one for the basilar process, and one for each condyle.

PARIETAL BONES.

Situation, upper and lateral parts of cranium; they are quadrilateral.

External surface, smooth, convex, and marked by a semicircular ridge, *the temporal ridge*, which is continuous with the temporal ridge of the frontal bone; close to the upper border is a foramen, the parietal foramen.

Internal surface, concave, and marked by the convolutions of the brain, and the ramifications of the middle meningeal artery, presents along its upper border a shallow groove, which, with its fellow, lodges the superior longitudinal sinus; external to this groove are shallow depressions, marking where the Pacchionian bodies were situated.

Four borders.—The upper is the longest, and joins its fellow; the anterior joins the frontal bone; the posterior the occipital, and is very irregular;

and the inferior is thick where it joins the mastoid process, but thin and semicircular where it is overlapped by the squamous portion of the temporal bone.

Four angles.—The anterior inferior is long and curved, and joins the sphenoid bone; upon its cerebral aspect is a canal or groove for the middle meningeal artery. The posterior inferior angle is grooved upon its cerebral aspect to lodge part of the lateral sinus. The superior angles are rather rounded. Each parietal bone articulates with five bones—the occipital, the frontal, its fellow of the opposite side, the sphenoid, and the temporal.

Development.—By one centre, from membrane.

FRONTAL BONE.

Situation, upper and anterior part of the skull.

External, or frontal aspect, is smooth, convex, and arched, and presents a median vertical depression, which marks the original division of the bone into two.

Frontal eminences, on each side of the median line, marking the points of ossification of the bone.

Superciliary ridges, two prominences which extend for about an inch on each side of the median line, below the frontal eminences; between the ridges is the *glabella*, or *nasal eminence*.

Nasal spine, a projection at the inferior part of the median line.

Orbital arches, form the upper margins of the orbits, and present towards their inner third the supra-orbital foramina or notches, for the passage of the supra-orbital nerve and artery.

External angular process, at the outer termination of the orbital arches.

Internal angular process, at the inner termination of the orbital arches.

Temporal ridges, extend backwards and upwards from the external angular process.

Internal, or cerebral aspect, is concave, and presents in the median line a groove, which corresponds to the superior longitudinal sinus.

Crest, at the commencement of the median groove, gives attachment to the falx cerebri.

Foramen cæcum, at the root of the crest, gives passage to a vein which opens from the nose into the longitudinal sinus.

On each side of the median groove are depressions which correspond with the convolutions of the brain.

Horizontal portion, or orbital processes, triangular, and form the roof of the orbit by their smooth concave surface, and on their convex surface are marked by convolutions of the brain. Towards the external angular process of each is a fossa for the lachrymal gland, and at the nasal margin is a

depression for the reflected tendon of the superior oblique muscle.

Ethmoidal notch, quadrilateral, is situated between the orbital processes, and articulates with the ethmoid bone by a serrated margin; its edges being cellular, to complete the ethmoidal cells.

Anterior and posterior ethmoidal foramina, along the margin of the ethmoidal notch, the anterior giving passage to the anterior ethmoidal vessels and nasal branch of the ophthalmic nerve, the posterior one to the posterior ethmoidal vessels.

Frontal sinuses, which exist only in the adult, at the anterior inferior part of the bone separating its two tables, open on each side of the nasal process.

It articulates with twelve bones—viz., the sphenoid, ethmoid, two parietal, two nasal, two superior maxillary, two lachrymal, and two malar.

Development.—By two centres in membrane—one for each frontal eminence.

TEMPORAL BONE.

Situation, at the lateral, middle, and inferior part of the skull. It is divided into squamous, mastoid, and petrous portions.

Squamous portion, vertical, semicircular, convex, and smooth on its external aspect; on its internal,

it is marked by the convolutions of the brain, and by grooves for the middle meningeal artery.

Zygomatic process, arises by two roots : one, anterior, passes inwards bounding the front of the glenoid cavity ; the other, posterior, bifurcates, of which one division passes in front of the external auditory meatus, the other passes horizontally backwards and is gradually lost. The process then passes forwards and terminates in a triangular serrated border to articulate with the malar bone.

Zygomatic tubercle, situated at the junction of the zygomatic roots, and gives attachment to the external lateral ligament of the lower jaw.

Glenoid fossa, transversely oval, deep anteriorly for the reception of the condyle of the lower jaw, and shallow posteriorly, where it lodges a portion of the parotid gland.

Glaserian fissure, crosses the glenoid fossa in a direction obliquely forwards and inwards. It transmits the laxator tympani muscle, the tympanic artery, and the processus gracilis of the malleus. The chorda tympani passes through a canal—canal of Huguier—which runs parallel to the Glaserian fissure and emerges close to the Eustachian tube.

Mastoid process, at the posterior and inferior aspect of the bone ; externally it is rough for the insertion of muscles ; internally it is grooved for the lateral sinus.

Mastoid grooves, internal to the mastoid process

for the occipital artery and the origin of the posterior belly of the digastric muscle.

Mastoid foramen, posterior to the mastoid process for the transmission of a vein to the lateral sinus.

Mastoid cells, in the interior of the mastoid process, and open into the posterior part of tympanum.

Petrous portion, containing in its interior the internal ear, extends forwards, inwards, and a little downwards, and presents three surfaces, three borders, a base, and an apex.

Anterior surface, presents for examination :

Depression for Gasserian ganglion on the anterior extremity.

Hiatus Fallopii, a foramen about the middle of the surface, for the passage of the great petrosal nerve. *A small opening* external to this for the lesser petrosal nerve.

The superior semicircular canal, forms an eminence behind the hiatus Fallopii.

Posterior surface presents for examination :

Meatus auditorius internus, about its middle, directed outwards for the transmission of the seventh pair of nerves and the auditory artery.

Aqueductus vestibuli, a small slit-like opening behind the internal meatus, for the passage of a vein.

Inferior surface presents for examination :

A rough surface for the origin of tensor tympani and levator palati.

Carotid canal, turns forwards, upwards, and inwards, and gives passage to the internal carotid artery and sympathetic plexus.

Aqueductus cochleæ, posterior to the styloid process, for the passage of a vein.

Jugular fossa, a smooth depression behind and a little external to the carotid foramen; it forms with the occipital bone, the foramen lacerum posterius, which transmits the internal jugular vein and the eighth nerves.

Foramen for Arnold's nerve, in the outer wall of the jugular fossa.

Foramen for Jacobson's nerve, in the ridge of bone between the jugular fossa and the carotid foramen, for the transmission of Jacobson's nerve to the tympanum.

Styloid process, long and tapering, descends obliquely forwards and inwards; affords origin to muscles and ligaments.

Vaginal process, a plate of bone between the carotid foramen and the mastoid process.

Stylo-mastoid foramen, between the styloid and mastoid processes for the exit of the facial nerve and the entrance of a small artery; near the foramen is a minute aperture for Arnold's branch of the pneumogastric nerve.

Auditory process, commencing by the external

meatus, leads inwards and forwards to the membrana tympani, and presents externally a rugged edge for the attachment of the cartilage of the ear.

Meatus auditorius externus, at the base of the petrous portion, leads to the tympanum.

The apex of the petrous portion presents the termination of the carotid canal.

Processus cochleariformis, a thin plate of bone separating two canals which are situated in the angle between the petrous and squamous portions; the superior of which transmits the tensor tympani muscle; the inferior forming the bony part of the Eustachian tube.

Borders: *the superior* gives attachment to the tentorium cerebelli, and is grooved for the superior petrosal sinus; *the posterior* presents in front a groove for the inferior petrosal sinus, and behind the jugular fossa; *the anterior* has an articulating border for the sphenoid.

The temporal articulates with five bones—the occipital, parietal, sphenoid, malar, and inferior maxilla.

Development.—By four centres, one for the squamous, one for the mastoid and petrous portions, one for the styloid process, and one for the auditory process.

SPHENOID BONE.

Situation, wedged transversely in the base of the skull.

Body, in the middle line, and presents six surfaces.

Superior surface, presents a fossa, called *sella turcica*, for the pituitary body ; in front of this is a transverse groove, the *olivary process*, on which the optic commissure rests ; still more anteriorly is a triangular process, the *ethmoidal spine* ; behind the pituitary fossa are two rounded eminences, the *posterior clinoid processes*, below which are two notches for the passage of the sixth nerve.

Posterior surface, is rough, for connexion with the basilar process of the occipital bone.

Anterior surface, presents the openings of the sphenoidal sinuses.

Inferior surface, presents the *rostrum*, which articulates with the vomer.

Lateral surfaces, join the great alæ, and are grooved for the internal carotid artery.

Great wings, extend laterally from the sides of the body ; each presents three aspects : an anterior, smooth and quadrilateral, to assist in forming the outer wall of the orbit ; the second, superior, concave, and marked by cerebral convolutions, to assist in forming the middle cranial fossa ; the third, external, is divided by a crest. The portion above forms part of the temporal fossa, and the portion below part of the zygomatic fossa.

Spinous processes, extend backwards and out-

wards, and form the posterior termination of each great wing.

Foramina rotunda, at the internal part of the great wing, gives passage to the second division of the fifth.

Foramina ovalia, posterior and external to the foramina rotunda, give passage to the third division of the fifth and the arteria meningea parva.

Foramina spinosa, in the spinous processes, give passage to the middle meningeal arteries.

Lesser wings, or *processes of Ingrassias*, two thin plates of bone, extend horizontally outwards and end in a pointed process. Internally they terminate in two rounded eminences, the *anterior clinoid processes*, immediately in front of which are the *optic foramina*, which give passage to the optic nerves and ophthalmic arteries. The anterior borders are serrated to articulate with the frontal bone ; the posterior are free and rounded, and afford attachment to the sphenoidal folds of the dura mater. The upper surface is smooth, to support the cerebral lobes ; the inferior forms the upper boundaries of the

Sphenoidal fissures, or *foramina lacera*, the lower boundary being formed by the greater wings ; each transmits the third, fourth, first division of the fifth, the sixth nerves, the ophthalmic vein, and some sympathetic fibres.

Pterygoid processes, one on each side, descend,

from the angle of junction of the great alæ and the body; each divides into two plates, an external, broad and irregular; and internal, long and narrow, which terminates in a hook-like process, the *hamular process*.

Pterygoid fossa, is the hollow between the pterygoid plates posteriorly.

Scaphoid fossa, at the base of the internal pterygoid plate, gives origin to the tensor palati.

Pterygo-palatine canals, two grooves at the inner aspect of the internal pterygoid plate, for the passage of the nerve and vessels of the same name.

Vidian canals, at the roots of the pterygoid processes for the passage of the Vidian nerves and vessels.

Cornua sphenoidalia, two thin plates of bone, which close in the sphenoidal sinuses.

The sphenoid articulates with all the bones of the cranium, and with five of the face—viz., the vomer, two malar, and two palate; occasionally with the two superior maxillary bones.

Development.—By ten centres; two for posterior part of the body, two for anterior part of body and lesser wings, two for the greater wings, two for the pterygoid processes, and two for the sphenoidal spongy bones.

ETHMOID BONE.

Situation, in the ethmoidal notch of the frontal

bone. It consists of a body, or central part, and two lateral masses.

Crista galli, vertical process which divides the cerebral aspect into two equal portions, to which is attached the commencement of the falx cerebri.

Cribriform plate, on each side of the crista galli, concave, to lodge the olfactory bulbs, and perforated with holes for the passage of the filaments of the olfactory nerves, the nasal division of the ophthalmic nerve, and some small blood-vessels.

Perpendicular plate, descends from the under surface of the crista galli, joins the sphenoid bone posteriorly, the vomer and nasal cartilage inferiorly, and the os frons and nasal bones anteriorly; it is thinner in the middle than at the edges, and usually inclined to one side. It is deeply grooved superiorly for the olfactory nerves.

Orbital plate, or *os planum*, a smooth square plate of bone situated externally and forming part of the orbit; in its upper edge are two notches, which, with those in the frontal bone, form the anterior and posterior ethmoidal foramina.

Ethmoidal cells, between the orbital plate and the perpendicular plate, being ten or twelve in number. They are divided into anterior and posterior. The former, the more numerous, communicate by means of the infundibulum with the frontal sinuses; the latter, few and small in size, open into the sphenoidal sinuses.

Superior spongy bone, descends in a curved manner outwards from the upper and posterior part of the bone, forming a short channel, called the superior meatus of the nose.

Middle spongy bone, larger and more curved, descends outwards, forming the middle meatus of the nose.

Infundibulum, a smooth groove leading from the anterior ethmoidal cells to the middle meatus.

Unciform process, an elongated lamella of bone, descending from the lateral mass to articulate with the inferior spongy bone.

The ethmoid articulates with thirteen bones—viz., sphenoid, frontal, vomer, two nasal, two superior maxillary, two lachrymal bones, two palate, and two inferior spongy bones.

Development.—By three centres—one for the horizontal plate and one for each lateral mass.

BONES OF THE FACE.

MALAR BONE.

Situation, at the outer and under part of the orbit, forming the prominent part of the cheek.

It is a quadrangular bone, and has two surfaces and four processes.

External surface, convex, and of irregular quadrilateral form.

Frontal process, at the upper and outer edge, joins the frontal bone.

Maxillary process, serrated, and rests at inner edge on the superior maxillary bone.

Zygomatic process, passes backwards, and supports the zygomatic process of the temporal bone by a serrated edge.

Upper border, forms the outer and inferior margin of the orbit.

Orbital process, a thin plate of bone, which passes from the upper edge backwards and inwards.

Lower border, thick and uneven, for the origin of the masseter muscle.

Temporal aspect, behind the zygomatic process, is smooth, for the lodgment of the temporal muscle.

Foramina, temporo-malar, one or two on the orbital process, which open, one on the posterior surface, and one on the cutaneous aspect—for vessels and branches of lachrymal nerves. It articulates with the frontal, superior maxillary, temporal, and sphenoid bones.

Development.—By one centre.

SUPERIOR MAXILLARY BONE.

Body, quadrilateral and hollow, forms anteriorly the *facial surface*; it presents a slight depression above the sockets of the incisor teeth, the myrtiform

or incisive fossa for the depressor alæ nasi; external to this, the canine fossa for the levator anguli oris muscle; and the opening of the infra-orbital canal for the infra-orbital vessels and nerve.

Orbital surface, triangular and horizontal, forms part of the floor of the orbit.

Infra-orbital canal, passes from behind forwards between the plates of the orbital surface and terminates in the *infra-orbital foramen*. It gives off a smaller canal, *anterior dental*, which conducts a smaller nerve to the incisor teeth.

Zygomatic surface, convex, separated from the facial surface by a vertical ridge; presents a number of small foramina, the *posterior dental foramina*, which give passage to the posterior dental vessels and nerves; inferiorly and posteriorly is the *tuberosity* which corresponds to the dens sapientiæ.

Nasal surface, presents an oblique ridge for the inferior turbinated bone, and posteriorly a groove for the lodgment of the lachrymal duct; behind the groove is the opening into the antrum.

Malar process, external and superior, presents a triangular rough surface for the malar bone.

Nasal process, internal and superior, is serrated above to join the frontal bone, and presents a rough margin in front of the nasal bone; posteriorly it is smooth to articulate with the lachrymal bone. Its cutaneous aspect is perforated by two or three small

foramina for blood-vessels ; its nasal aspect presents a ridge for the middle turbinated bone.

Alveolar process, forms the lower part of the body, and is hollowed out into sockets for eight teeth.

Palatine process, horizontal, is thick internally, and rough where it joins its fellow ; its circumference corresponds to the alveolar processes, and its posterior edge is thin and serrated where it joins the palate bone ; its upper surface is smooth and concave from side to side, forming part of the floor of the nose, and its under surface is rough, forming part of the hard palate.

Nasal crest, at the union of the palatine processes, projects upwards to receive the vomer.

Nasal spine, projects forwards above and between the central incisor teeth.

Foramen incisivum, is common to both bones, and exists inferiorly at the anterior union of their palatine plates ; superiorly it bifurcates and opens by two foramina, one to each nostril.

Sinus maxillaris, or *antrum Highmori*, a large pyramidal cavity in the body of the bone, bounded above by the orbital plate, below by the alveoli of the molar teeth, anteriorly by the canine fossa, and posteriorly by the temporal aspect ; externally it corresponds to the malar process, and internally it presents a large irregular opening.

The superior maxilla articulates with nine or ten

bones—viz., with its fellow of the opposite side, with the frontal, os nasi, lachrymal, ethmoid, with the malar, vomer, inferior spongy bone, palate, and occasionally with the sphenoid.

Development.—By four centres—one for the facial and nasal portions, one for the orbital portion, one for the incisive portion, and one for the palatine portion.

PALATE BONE.

Horizontal, or *palate plate*, quadrilateral, is concave and smooth above, and completes the floor of the nose, and rough below, where it completes the hard palate. Its anterior edge is serrated to join the superior maxillary bone; its posterior edge is concave, and gives attachment to the soft palate; its inner edge is serrated where it joins its fellow, and sends a *crest* upwards to support the vomer; its outer edge joins the nasal plate.

Nasal spine, projects backwards from the union of the palate plates, and gives origin to the azygos muscle.

Vertical process, broad and thin; its inner surface is divided into two by a ridge which supports the inferior spongy bone; above and below this ridge the process is slightly concave, to assist in forming the inferior and middle meatuses; its external surface is rough, and marked by the posterior palatine vessels and nerves; its anterior

thin edge assists to close the antrum, and the posterior edge joins the pterygoid processes of sphenoid bone.

Pterygoid process, the thickest part of the bone, of a wedge shape, inclines backwards and outwards; it presents three grooves—a central one, smooth, which completes the pterygoid fossa, and a rough one on either side to articulate with the extremities of the pterygoid plates.

Palatine foramina, at the junction of pterygoid and palatine processes, give passage to the posterior palatine nerve and vessels.

The vertical plate divides at its upper part into two processes—an anterior or orbital, and a posterior or sphenoidal process. The notch at the point of bifurcation is the *spheno-palatine*, completed into a foramen by the sphenoid bone.

Orbital process, is large and hollow, and of triangular form; it presents five surfaces, three articulated, two free. The anterior articulates with the superior maxilla, the posterior with the sphenoid, the internal with the ethmoid. The superior forms part of the floor of the orbit; the external looks into the zygomatic fossa.

Sphenoidal process, articulates with the body of the sphenoid bone, and is also hollow, forming the pterygo-palatine canal.

It articulates with seven bones—viz., the corresponding palate bone, the superior maxilla, eth-

moid, sphenoid, vomer, inferior spongy bone, and the sphenoidal spongy bone.

Development.—By one centre.

INFERIOR SPONGY BONE.

Rough and convex towards the septum of the nose, and concave externally ; presents a free margin inferiorly, and is attached above to the lachrymal bone and ethmoid, and to the ridge on the superior maxillary and palate bones. It completes the nasal duct inferiorly, and helps to close in the antrum by its maxillary process.

Development.—By one centre.

LACHRYMAL BONE.

Situation, inner and front part of orbit.

Edges, serrated to join the os frontis above, the ethmoid bone behind, and the inferior spongy bone below ; smooth to join the nasal process of the superior maxillary in front.

External surface, divided by a perpendicular ridge, presents a groove anteriorly for the lachrymal sac, and a smooth surface behind to assist in forming the orbit.

Internal surface, closes in the anterior ethmoidal cells:

Development.—By one centre.

NASAL BONE.

Situation, above the nasal process of frontal bone, and between the nasal processes of superior maxillary bones.

External surface, convex, presents small foramina for blood-vessels.

Internal surface, concave, and grooved for the nasal nerves.

Superior edge, thick and serrated, to join the frontal bone.

Inferior edge, thin and expanded, joins the lateral nasal cartilage.

External edge, is the longest, and is serrated to join the superior maxillary bone.

Internal edge, is flat, and joins its fellow.

The nasal bone articulates with the frontal superior maxilla, ethmoid bone, and fellow.

Development.—By one centre.

VOMER.

Situation, in the middle line of nose, forming part of its septum.

Superior edge, grooved to receive the azygos process of the sphenoid bone.

Anterior edge, slightly grooved to receive the ethmoidal plate and nasal cartilage.

Posterior edge, free, looks towards the pharynx.

Inferior edge, the longest, is received into the nasal crest of the superior maxillary and palate bones.

Naso-palatine groove, runs along the outer surface in its long axis.

Development.—By two centres.

INFERIOR MAXILLARY BONE.

Body, the anterior portion projects inferiorly into *mental process or chin*, superiorly is surmounted by alveoli of four incisor teeth, anteriorly has on each side a depression for muscles, and posteriorly two depressions for the digastric muscles, above which are two pairs of tubercles—the inferior for the genio-hyoidei, and the superior for the genio-hyo-glossi muscles.

Symphysis, a vertical ridge in the centre of body.

Horizontal rami.—On the outer surface of each is an oblique ridge for muscles; on the inner is the mylo-hyoidean ridge, above which is a depression for the sublingual gland, and another below for the submaxillary gland. The lower edge is rounded and grooved for the facial artery, and upon the upper edge are alveolar processes.

Angle, obtuse and rough for muscles.

Ascending rami, are thick and round posteriorly, externally smooth, internally grooved.

Coronoid process, passes upwards from anterior part of ascending ramus.

Condyle, transversely oblong to articulate with temporal bone.

Neck, constricted part below condyle.

Sigmoid notch, between condyle and coronoid process.

Inferior dental foramen, situated at internal surface of ascending ramus, and surmounted by a spine.

Mental foramen, situated at anterior surface of bone external to body.

Dental canal, traverses bone between the two foramina, and communicates with each alveolus.

It articulates with the glenoid fossæ of the two temporal bones.

Development.—By two centres, which coalesce at the symphysis.

OS HYOIDES.

Situation, in the anterior part of the neck between the chin and larynx.

Body, square, is rough anteriorly for muscles, and smooth behind where it corresponds to the epiglottis.

Greater cornua, pass obliquely backwards from the sides of the body, and end in tubercles.

Lesser cornua, are very small, and pass obliquely backwards and upwards from the point of junction

of the great cornua and body, and connect the bone with the styloid process of temporal bone by means of the stylo-hyoid ligaments.

Development.—By five centres, one for the body and one for each cornu.

The bones of the ear are described in connexion with the organ of hearing.

SUTURES OF THE CRANIUM AND FACE.

Coronal suture, commences a little behind the external angular process of the frontal bone, at the upper termination of the great wing of the sphenoid bone, and, inclining backwards, extends across the cranium to the opposite corresponding point, connecting in its course the frontal with the parietal bones.

Lambdoid suture, commences at the union of the petrous portion of the temporal bone with the parietal and occipital bones, and extending across the posterior part of the cranium to the opposite corresponding point, connects the occipital with the parietal bones.

Sagittal suture, extends from the angle of the occipital bones forwards, connecting in its course the parietal bones, and corresponding to the median line; it generally terminates in the coronal suture, but is occasionally prolonged to the nasal bones, dividing the frontal bone.

Squamous suture, corresponds to the semicircular edge of the squamous portion of the temporal bone, and connects it with the great wing of the sphenoid bone and with the parietal bone.

Masto-occipital suture, extends from the termination of the lambdoid suture to the foramen lacerum posterius, and unites the mastoid process of the temporal bone to the occipital.

Masto-parietal suture, extends nearly horizontally backwards from the posterior termination of the squamous suture to the lambdoid suture, connecting the upper extremity of the mastoid portion of the temporal bone with the parietal bone.

Sphenoid suture, extends around the irregular margins of the sphenoid bone, connecting it with all the bones of the head, and with the malar, superior maxillary, and palate bones.

Ethmoid suture, surrounds the ethmoid bone, connecting it with the frontal, nasal, superior maxillary, lachrymal, and palatine bones, and with the vomer.

Transverse suture, connects the bones of the face with those of the head.

Zygomatic suture, corresponds to the junction of the temporal with the malar bone.

ORBITS.

The orbits are two pyramidal cavities, the bases of which look outwards and forwards, and their

apices in the contrary direction ; so that two lines passing through their axes if prolonged posteriorly would meet at the sella turcica. Each orbit is formed of seven bones, three of which—viz., the frontal, sphenoid, and ethmoid, are common to both orbits; the other four—viz., the lachrymal, superior maxillary, malar, and palate bones belonging to the orbit of their corresponding side. *The roof* is formed by the lesser wing of the sphenoid bone and the orbital plate of the frontal. At the outer angle is a depression for the lachrymal gland ; at the inner a depression for the pulley of the superior oblique muscle. *The floor* is formed by the superior maxilla, the malar, and palate bones, and contains the infra-orbital canal. *The outer wall* is formed by the malar and sphenoid bones ; it is pierced by some small foramina for nerves ; *the inner* is formed by the os planum of the ethmoid, the lachrymal bone, superior maxilla, and a piece of the sphenoid. It is perforated by the anterior and posterior ethmoidal foramina. The foramina in the base of the orbit are, the supra-orbital, the infra-orbital, and the upper orifice of the nasal duct, and the temporo-malar ; within the orbit are the optic foramen, the sphenoidal fissure, and the speno-maxillary fissure. Through the optic foramen passes the optic nerve and ophthalmic artery. Through the fissura sphenoidalis the third, fourth, ophthalmic division of the fifth nerve, the sixth

nerve, and the ophthalmic vein, and some filaments of the sympathetic.

TEMPORAL FOSSA,

Placed on the side of the cranium, is bounded by the frontal, sphenoid, malar, parietal, and temporal bones, and lodges the temporal muscle. It is traversed by five sutures, the transverse facial, the spheno-parietal, squamo-parietal, squamo-sphenoid, and coronal.

ZYGOMATIC FOSSA,

Extends from the temporal fossa downwards, and is bounded by the zygomatic arch, the superior maxillary bone, and the portion of the great wing of the sphenoid bone below its crest. Between the great wing of the sphenoid and the border of the superior maxillary bone is the spheno-maxillary fissure, which opens into the orbit.

PTERYGO-MAXILLARY FISSURE,

Lies deep in the zygomatic fossa, is bounded by the pterygoid processes, the tuberosity of the superior maxilla, and the nasal process of the palate bone; and communicates with the spheno-maxillary fissure. The angle of union of the spheno-maxillary and pterygo-maxillary fissures is called

the *spheno-maxillary fossa*, into which five foramina open : foramen rotundum, for second branch of fifth cerebral nerve ; Vidian canal, for the Vidian nerve ; pterygo-palatine, for a small artery ; posterior palatine, for nerves and arteries ; spheno-palatine, which lodges the spheno-palatine ganglion ; also two fissures, the pterygo-maxillary and spheno-maxillary.

NASAL FOSSÆ,

Are two cavities which extend from the palate processes of the superior maxillæ and palate bones to the base of the cranium. They open in front by the two anterior nares, and posteriorly by the two posterior nares, and are separated from each other by the septum nasi.

The roof is formed by the nasal bones, the nasal spine of the frontal, the cribriform plate of the ethmoid, the body of the sphenoid, and the sphenoidal spongy bones.

The floor is formed by the palate processes of the superior maxillary and palate bones.

The outer wall is formed by the nasal bone, the nasal process of the superior maxilla, the lachrymal, the ethmoid, the inner surface of the superior maxilla and inferior turbinated bones, and by the vertical plate of the palate bone.

The septum is formed by the nasal spine of the frontal, the ridge of the nasal bones, the rostrum

of the sphenoid, vomer, perpendicular plate of the ethmoid, and the ridge formed by the two superior maxillæ and palates bones.

ARTICULATIONS

These may be divided into three: *synarthrosis*, *amphiarthrosis*, and *diarthrosis*.

1. *Synarthrosis*, or immovable articulations, comprise those which are immovably connected, and allow of no movement between each other. This class is subdivided into *sutura*, *schindylesis*, and *gomphosis*. Of the *sutura* there are two varieties—the true, which articulate by indented borders, and the false, whose surfaces are simply apposed. The true sutures include the *dentata*, *serrata*, and *limbosa*; the false comprise the *squamosa* and *harmonia*.

Schindylesis, where a thin plate of bone is received into a cleft formed by two diverging plates, as the rostrum with the vomer.

Gomphosis, as the teeth are received into the alveoli.

2. *Amphiarthrosis*, or partly moveable articulations, include those surfaces connected by fibro-cartilage, as between the bodies of the vertebræ and those invested with fibro-cartilage, lined by a partial synovial membrane, as in the pubic symphysis.

3. *Diarthrosis*, or moveable joints. Includes *arthrodia*, or gliding joints, as in carpus and tarsus; *ginglymus*, or hinge-joint, as in the elbow-joint; *enarthrosis*, or ball-and-socket joint, as the shoulder and hip; and *diarthrosis rotatorius*, or lateral ginglymus, which allows movements around a pivot process, as in the atlo-axoid joint.

TEMPORO-MAXILLARY ARTICULATION.

Bony formation, glenoid cavity of temporal bone, and condyle of inferior maxilla.

External lateral ligament,—*origin*, zygomatic process and tubercle of temporal bone. *Insertion*, outer side of the neck of condyle of lower jaw.

Internal lateral ligament,—*origin*, spinous process of sphenoid bone. *Insertion*, margin of inferior dental foramen.

Stylo-maxillary ligament,—*origin*, styloid process of temporal bone. *Insertion*, angle of inferior maxilla.

Capsular ligament,—*origin*, zygomatic eminence and glenoid fissure. *Insertion*, neck of lower jaw.

Synovial membranes; two, one is reflected from the cartilaginous surface of zygomatic eminence and glenoid cavity over the superior surface of the fibro-cartilage; the other covers the under surface of the fibro-cartilage, and is reflected over the condyle.

Inter-articular, or *fibro-cartilage*, of oval figure, thick in its circumference, thin in the centre, where it is sometimes perforated. Divides the joint into two.

Nerves, from the auriculo-temporal and masseteric branch of the inferior maxillary.

OCCIPITO-ATLOID ARTICULATION

Bony formation, condyles of occipital bone and superior articular process of atlas.

Two capsular ligaments, imperfect.

Synovial membranes, cover the opposed cartilaginous surfaces.

Two anterior occipito-atloid ligaments,—*origin*, anterior edge of foramen magnum. *Insertion*, upper edge of atlas, anterior to its articular processes.

Posterior occipito-atloid ligament,—*origin*, posterior edge of foramen magnum. *Insertion*, upper edge of atlas behind its articular processes.

Two lateral ligaments,—*origin*, jugular process of occiput. *Insertion*, transverse process of atlas.

OCCIPITO-AXOID ARTICULATION.

Check, or oblique ligaments, (*Syn.*) *Ligamenta alaria*; *odontoid ligaments*,—*origin*, from each side of head of odontoid process. *Insertion*, inner side of each occipital condyle. A third ligament (*ligamentum suspensorium*) passes from the tip of the

odontoid process to the margin of the foramen magnum.

Apparatus ligamentosus colli, or *occipito-axoid ligament*,—*origin*, lower part of basilar process, posterior to odontoid process. *Insertion*, bodies of second and third vertebræ, where it is continuous with the posterior common ligament.

ATLO-AXOID ARTICULATION.

Bony formation, the anterior portion of the canal of the atlas, and the odontoid process of axis; no inter-vertebral substance.

Anterior and posterior ligaments, as in all the other vertebræ.

Transverse ligament, attached on each side to inner edge of articular process of the atlas, and to basilar process above, and body of axis below.

Two capsular, thin, between the articulating surfaces of the two bones.

Synovial membranes, one between posterior surface of odontoid process, and anterior surface of transverse ligament; the other covers the opposed cartilaginous surfaces of the atlas and odontoid process.

COMMON VERTEBRAL ARTICULATION.

Bony formation, opposed surfaces of the bodies connected by the inter-vertebral fibro-cartilages, and articular processes of the vertebræ.

Anterior common ligament, a strong band of fibres extending along the front of the spinal column from axis to sacrum. It adheres strongly to the bodies and inter-vertebral substances.

Posterior common ligament, extends along the posterior surface of bodies of vertebræ within the spinal canal. It is separated from the bodies of the vertebræ by some large veins.

Inter-vertebral fibro-cartilages, are placed between the bodies of all the vertebræ, except the atlas and the axis, and united to the flat surfaces above and below. They are thicker in front than behind in the cervical and lumbar regions, the reverse in the dorsal, where they are attached to the heads of the ribs.

Ligamenta subflava, composed of yellow elastic tissue, are situated between the laminæ of adjacent vertebræ from the axis to the sacrum. They increase in thickness in the lower part of the spine, and complete the posterior part of the spinal canal.

Capsular ligaments, connect the opposed articular surfaces, and are lined by synovial membrane.

Supra-spinous and inter-spinous ligaments; the former connect the summits of the spinous process, the latter pass between the borders of the spinous processes.

Inter-transverse ligaments, connect the transverse processes; sometimes absent in the cervical region.

COSTO-SPINAL ARTICULATIONS.

Bony formation, heads, and tubercles of ribs with bodies and transverse processes of vertebræ.

Anterior costo-vertebral, or stellate ligament,—*origin*, anterior part of head of rib. *Insertion*, side of the bodies of the vertebræ above and below, and to the inter-vertebral substance by radiating fibres.

Inter-articular ligament,—*origin*, from projecting ridge on the articular surface of each rib. *Insertion*, into the inter-vertebral substance into which the head is received. It divides the joint into two separate divisions, which are lined with distinct synovial membranes. Absent in the first, eleventh, and twelfth ribs.

Costo-transverse ligaments, three in number.

Anterior costo-transverse ligament,—*origin*, neck of each rib. *Insertion*, transverse process of the vertebra above. Absent in the first rib.

Posterior costo-transverse ligament, connects the tubercle of each rib with the apex of the corresponding transverse process. Absent in eleventh and twelfth ribs.

Middle, or inter-osseous, costo-transverse ligament, connects the neck of the rib to the contiguous transverse process; to see it the bones must be forcibly separated. Rudimentary in eleventh and twelfth ribs.

Capsular, connects the tubercle of the rib with transverse process and encloses a small synovial membrane.

Synovial membranes, are between the tubercles and the transverse processes.

COSTO-STERNAL ARTICULATION.

The ribs are connected with the sternum by *anterior and posterior costo-sternal* ligaments, which pass from the cartilages of the ribs to the sternum, the anterior being the stronger. Synovial membranes exist between the cartilages and the sternum, except in the first, where the cartilage is continuous with the bone.

LUMBO-SACRAL ARTICULATION.

Bony formation, last lumbar vertebra and sacrum. These are united together in the same manner as the other vertebræ.

The spine is connected with the pelvis by the *ilio-lumbar* and *lumbo-sacral* ligaments.

Ilio-lumbar ligament,—*origin*, transverse processes of fifth lumbar vertebræ. *Insertion*, posterior, superior spinous process and crest of the ilium.

Lumbo - sacral ligament,—*origin*, lower part of transverse process of fifth lumbar vertebra. *Insertion*, lateral aspect of base of sacrum.

ILIO-SACRAL ARTICULATION.

The ilium and sacrum are connected together by *anterior and posterior sacro-iliac ligaments*; the posterior is much the stronger, two of the bands being horizontal and the third oblique.

SACRO-SCIATIC LIGAMENTS.

Great sacro-sciatic ligament,—*origin*, posterior inferior spine of ilium, and side of sacrum and coccyx. *Insertion*, lower border of tuber ischii. Along the ramus of the ischium it sends a falciform prolongation which covers the obturator internus muscle.

Lesser sacro-sciatic ligament,—*origin*, side of sacrum and coccyx. *Insertion*, spine of ischium.

These ligaments convert the great lateral pelvic notch into two foramina, called the *greater and lesser sacro-sciatic foramina*. The former, superior, transmits the pyramidalis, greater and lesser sacro-sciatic nerves, the gluteal vessels and nerve, the pudic vessels and nerve and the sciatic artery, and the nerve to the obturator internus; the latter, inferior, and bounded by the two ligaments, transmits the tendon of the obturator internus muscle, the pudic vessels and nerve, and the nerve to the obturator internus muscle.

SACRO-COCCYGEAL ARTICULATION.

The sacrum and coccyx are united together by *anterior* and *posterior* sacro-coccygeal ligaments, and by a similar substance to the inter-vertebral.

PUBIC ARTICULATION.

Anterior pubic ligament, consists of decussating fibres in front of pubes.

Posterior pubic ligament, unites the pubic bones posteriorly.

Superior pubic ligament, passes along the upper border of the bones.

Sub - pubic ligament, or *ligamentum arcuatum*, passes from the ramus of one bone to the other, and rounds off the angle formed by their union.

Fibro-cartilage, which attaches closely the pubic bones. It is composed of two plates, firmly attached on their outer aspects to the pubic bones, and between them exists a synovial cavity at the upper and back part.

Obturator membrane, attached to the margin of the obturator foramen, except superiorly, where the obturator vessels and nerve pass through.

STERNO-CLAVICULAR ARTICULATION.

Anterior ligament,—*origin*, anterior surface of

sternal end of clavicle. *Insertion*, anterior surface of sternum.

Posterior ligament,—*origin*, posterior surface of sternal end of clavicle. *Insertion*, back part of sternum.

Costo-clavicular ligament,—*origin*, lower surface of sternal end of clavicle. *Insertion*, cartilage of first rib.

Inter-clavicular ligament, or *rhomboid*, extends from the sternal extremity of one clavicle to that of the other, dipping down in its course to become attached to the upper border of the sternum.

Inter-articular cartilage, thin below and attached to sternum; thick above and attached to clavicle; having a synovial membrane connected to each surface and its corresponding bone.

SCAPULO-CLAVICULAR ARTICULATION.

Superior acromio-clavicular ligament,—*origin*, upper surface of acromion. *Insertion*, upper part of clavicle.

Inferior acromio-clavicular ligament, attached to under surface of each bone.

Synovial membrane covers the articulating surfaces in the usual manner.

There is occasionally an imperfect inter-articular fibro-cartilage.

Coraco-clavicular ligaments are divided into :

Conoid ligament, triangular; base connected to the tubercle on inferior surface of clavicle, apex at the broad part of coracoid process.

Trapezoid ligament, attached above to an oblique line on the clavicle; below to upper part of the coracoid process.

There is no true division of these ligaments; they consist of one fibrous layer twisted upon itself.

LIGAMENTS OF THE SCAPULA.

Coraco-acromial ligament,—*origin*, broad from coracoid process. *Insertion*, narrow into point of acromion.

Transverse or coracoid ligament,—*origin*, superior costa of scapula behind the notch. *Insertion*, base of coracoid process. This ligament converts the notch into a foramen, through which passes the supra-scapular nerve, the supra-scapular artery passing over it.

HUMERO-SCAPULAR ARTICULATION.

Bony formation, head of humerus and glenoid cavity of scapula.

Capsular ligament,—*origin*, circumference of neck of scapula. *Insertion*, around the anatomical neck of humerus. It is strengthened by the coraco-humeral ligament, and by prolongations from the

tendons of the supra and infra-spinatus and teres minor and subscapularis muscles.

Coraco-humeral ligament,—*origin*, coracoid process. *Insertion*, anterior part of great tuberosity.

Synovial membrane, is reflected over the surface of the glenoid cavity around the glenoid ligament; lines the capsular ligament, head of humerus, and bicipital groove.

Glenoid ligament, closely connected with the tendon of the biceps muscle, encircles the glenoid cavity, and by elevating the border, adds to the depth of the articular surface.

Nerves, from the circumflex and supra-scapular.

ELBOW-JOINT.

Bony formation, articular processes of humerus, great sigmoid cavity of ulna, head of radius.

External lateral ligament,—*origin*, external condyle of humerus. *Insertion*, annular ligament of radius, and outer margin of ulna.

Internal lateral ligament,—*origin*, internal condyle. *Insertion*, inner edge of olecranon and coronoid process.

Anterior ligament, consists of thin fibres,—*origin*, principally from above internal condyle and depression on front part of humerus. *Insertion*, annular ligament of radius and coronoid process of ulna.

Posterior ligament, is composed of fibres which

extend from one condyle to the other and are attached to the margin of the olecranon.

Synovial membrane, is reflected from behind the anterior ligament to neck of radius and annular ligament; it then lines the sigmoid cavities of the ulna, and is reflected to the lateral ligaments and tendon of the triceps muscle, which conducts it to the posterior depression of the humerus; it is then expanded over its articular surfaces.

Nerves, from the ulnar and musculo-cutaneous.

SUPERIOR RADIO-ULNAR ARTICULATION.

Bony formation, lesser sigmoid cavity of ulna, and inner side of head of radius.

Annular ligament,—*origin*, anterior border of lesser sigmoid cavity of ulna. *Insertion*, posterior border of the same cavity. It encircles the neck of radius.

Oblique ligament,—*origin*, coronoid process of ulna. *Insertion*, radius below its tubercle.

Inter-ossous membrane, connects the opposed edges of radius and ulna, its fibres descending obliquely inwards from the former bone to the latter.

INFERIOR RADIO-ULNAR ARTICULATION.

Bony formation, round head of ulna and sigmoid cavity of radius; the bones are united by some thin

fibrous bands, which are called the *anterior and posterior radio-ulnar ligaments*.

Fibro-cartilage,—*origin*, styloid process of ulna. *Insertion*, inner edge of radius below the ulna.

The synovial membrane, called sometimes *membrana sacciformis*, extends horizontally between the extremity of the ulna and the fibro-cartilage, and vertically between the opposed articulating surfaces of the radius and ulna.

RADIO CARPAL ARTICULATION.

Bony formation, lower end of radius; scaphoid, lunar, and cuneiform bones.

The extremity of the ulna is excluded from the joint by the fibro-cartilage.

External lateral ligament,—*origin*, styloid process of radius. *Insertion*, scaphoid bone, and by some fibres into annular ligament and trapezium.

Internal lateral ligament,—*origin*, styloid process of ulna. *Insertion*, cuneiform, pisiform bones, and annular ligament.

Posterior ligament,—*origin*, posterior part of radius and fibro-cartilage. *Insertion*, back part of superior row of carpal bones.

Anterior ligament,—*origin*, anterior part of radius and fibro-cartilage. *Insertion*, fore part of first row of carpal bones.

The synovial membrane lines the head of the

radius, the fibro-cartilage, and is then reflected over the three carpal bones.

Nerves, from the ulna and posterior inter-osseous.

CARPAL ARTICULATIONS.

The bones of the carpus are articulated by ligamentous bands, both anteriorly and posteriorly.

The scaphoid, lunar, and cuneiform bones are connected by dorsal and palmar ligaments, extending from bone to bone : between the opposed borders are inter osseous ligaments.

The pisiform bone possesses a distinct fibrous capsule and synovial membrane.

The trapezium, trapezoid, os magnum, and unciform are also connected by dorsal and palmar ligaments.

Inter-osseous ligaments are found on each side of the os magnum.

Lateral ligaments extend on the radial side from the scaphoid to the trapezium ; on the ulnar side from the cuneiform to the unciform.

The carpal synovial membrane extends between the first and second row of carpal bones, and is prolonged to the carpal extremities of the four inner metacarpal bones. The trapezium articulates with the metacarpal bone of the thumb by a distinct capsule and synovial membrane.

Annular ligament,—*origin*, trapezium and scaphoid bones. *Insertion*, cuneiform and unciform bones.

CARPO-METACARPAL ARTICULATION.

The carpus and metacarpus are secured by fibrous bands, which pass in different directions, and cover the synovial membranes.

METACARPO-PHALANGEAL ARTICULATIONS.

The heads of the metacarpus and first phalanges are secured by *lateral ligaments*, and are lined by *synovial membranes*: a transverse ligament connects the digital extremities of the metacarpal bones one with another: an *anterior* connects the palmar surfaces of the two bones.

INTER-PHALANGEAL ARTICULATIONS.

The phalanges are connected to each other by means of anterior and lateral ligaments, and between each of these joints is a synovial membrane.

HIP-JOINT.

Bony formation, acetabulum and head and part of neck and femur.

Capsular ligament,—*origin*, circumference of ace-

tabulum and transverse ligament. *Insertion*, below root of trochanter major, the anterior inter-trochanteric line, and posteriorly to the middle of the neck of the femur. Behind the ligament is very thin and loose.

Accessory, or ilio-femoral ligament,—*origin*, anterior inferior spine of ilium. *Insertion*, into anterior inter trochanteric line.

Ligamentum teres,—*origin*, depression on head of femur. *Insertion*, by two bands into the extremities of the notch, and into the transverse ligament.

Cotyloid ligament, a circular fibro-cartilaginous band attached to the margin of the acetabulum.

Transverse ligament, attached to the opposite points of the notch, converting it into a foramen for the passage of the nutrient vessels of the joint.

Synovial membrane, reflected from inside of capsule upon periosteum of neck and cartilaginous surface of head ; is continued over ligamentum teres, and thence is reflected upon the cartilaginous surface of acetabulum.

Nerves, from the obturator, great sciatic, sacral plexus, and accessory obturator if present.

KNEE-JOINT.

Bony formation, condyles of femur, head of tibia, and the patella.

Ligamentum patellæ,—*origin*, lower angle of patella. *Insertion*, tubercle of tibia.

Posterior ligament,—*origin*, tendon of semi-membranosus muscle at internal and posterior part of tibia. *Insertion*, external condyle of femur.

Internal lateral ligament,—*origin*, internal condyle of femur. *Insertion*, internal surface of tibia and semilunar cartilage. It is long and flat.

External lateral ligament,—*origin*, external condyle of femur. *Insertion*, head of fibula. This ligament is often divided into two by the tendon of the biceps muscle. It is short and round.

Synovial membrane, lines the back part of the patella, from which it is reflected two or three inches on the fore part of the femur, and on its condyles; from thence it is conducted by the crucial ligaments to the semilunar cartilages, and head of tibia.

Alar ligaments, arise from each side of patella, and unite below that bone. They are mere folds of synovial membrane.

Ligamentum mucosum,—*origin*, fatty substance behind ligamentum patellæ. *Insertion*, hollow, between the condyles. It is also a fold of synovial membrane.

Coronary ligaments, connect the circumferences of the semilunar cartilages to the tibia.

Transverse ligament, attached to the anterior portion of each semilunar cartilage.

Anterior crucial ligament, oblique,—origin, inner side of external condyle. *Insertion*, near the fore part of spine of tibia, where it is connected to the cornu of the internal semilunar cartilage.

Posterior crucial ligament, vertical,—origin, inner side of internal condyle. *Insertion*, depression on back part of head of tibia, and external semilunar cartilage.

Semilunar cartilages, thick externally, thin internally ; concave above, flat below. The outer convex edge of the internal is attached to the lateral ligament ; the inner edge is free ; the anterior and posterior extremities of each are attached to the head of the tibia. The outer cartilage is circular, the inner is semicircular.

Nerves, from the obturator, anterior crural, external and internal popliteal.

TIBIO-FIBULAR ARTICULATION.

The head of the fibula is attached to the tibia by *anterior* and *posterior fibrous bands* and synovial membrane.

Interosseous membrane, extends from one bone to the other nearly the whole length.

The lower extremities of the tibia and fibula are connected together by *anterior* and *posterior ligaments* ; the synovial membrane is a prolongation of that which lines the ankle joint.

ARTICULATION OF THE ANKLE.

Bony formation, lower ends of tibia, fibula, and astragalus.

Internal lateral ligament,—*origin*, internal malleolus. *Insertion*, astragalus, os calcis, scaphoid, and calcaneo-scaphoid ligament.

External lateral ligaments are three; all take their *origin* from the external malleolus. *Insertion* of *anterior*, upper and outer part of astragalus. *Insertion* of *middle*, os calcis. *Insertion* of *posterior*, ridge on the back of astragalus, which bounds the groove for the flexor longus pollicis.

Anterior ligament,—*origin*, anterior edge of tibia. *Insertion*, upper and outer part of astragalus.

The synovial membrane covers the opposed surfaces of the bones, and sends upwards a prolongation into the inferior tibio-fibular articulation.

Nerve, from the anterior tibial.

ARTICULATION OF THE TARSUS.

The astragalus and os calcis have two articular surfaces, covered by synovial membranes.

Interosseous ligament, passes nearly perpendicularly from the groove which separates the inferior articular surfaces of the astragalus, to the corresponding groove in the os calcis.

Posterior ligament, is attached to the posterior edges of the astragalus and os calcis.

External lateral ligament, passes from the astragalus to the outer surface of the os calcis.

There are two synovial membranes : one posterior to the interosseous ligament, between the astragalus and os calcis ; a second anterior to the interosseous ligament, between the astragalus and os calcis, and continued forwards between the astragalus and scaphoid bone, over the calcaneo-scaphoid ligament.

The bones of the tarsus are connected on their dorsal and plantar aspects by numerous ligamentous bands.

Calcaneo-scaphoid ligament,—*origin*, inferior surface of os calcis. *Insertion*, inferior surface of scaphoid bone.

It is composed of elastic tissue, and is supported inferiorly by the tendon of the tibialis posticus muscle ; superiorly it forms with the os calcis and scaphoid bone a cup, which receives the head of the astragalus.

Calcaneo-cuboid ligament,—*origin*, posterior inferior part of os calcis. *Insertion*, under part of cuboid bone, and third and fourth metatarsal bones.

The superficial fibres, longer than the deeper, form the “*ligamentum longum plantæ*.” There is a distinct synovial membrane between the calcaneum and cuboid bones.

The three cuneiform bones are connected by dorsal, plantar, and interosseous ligaments: one synovial membrane is reflected over their opposed surfaces with the scaphoid bone.

If an oblique section be made through the tarsus and metatarsus, the six synovial membranes will be demonstrated. One between the os calcis and astragalus, behind the interosseous ligament; one between the same bones in front of that ligament and running up between the anterior surface of the astragalus and the fossa of the scaphoid; a third between the os calcis and the cuboid; a fourth between the cuboid and bases of the fourth and fifth metatarsal bones; a fifth between the scaphoid and three cuneiform bones, which runs forward between these bones and the bases of the second and third metatarsal bones, and the sixth between the internal cuneiform bone and the metatarsal bone of the great toe.

TARSO-METATARSAL ARTICULATIONS.

These joints are secured by dorsal and plantar ligaments, and are lined by synovial membranes. The metatarsal bones are secured to the phalanges, and the phalanges to each other, by lateral ligaments and synovial membranes. There is one synovial membrane between the internal cuneiform bone and the first metatarsal bone; a second be-

tween the os cuboides and the fourth and fifth metatarsal bones. The second and third metatarsal bones form part of the articulation between the cuneiform and scaphoid bones.

THE FASCIÆ.

CERVICAL FASCIA.

The superficial fascia is thin, and intimately connected with the fibres of the platysma myoides. The deep fascia binds down and invests the muscles of the neck. It is a strong dense pearly-white structure, attached behind to the spines of the cervical vertebræ, in front to the mesial line, and below to the clavicle and sternum; above it is connected with the jaw and parotid gland; and it sends a process from the styloid process to the angle of the jaw, known as the stylo-maxillary ligament. The sterno-mastoid, the omo-hyoid, and the subclavius muscles, receive complete sheaths of fascia; the sheath of the great vessels of the neck is strengthened by it.

SUPERFICIAL FASCIA OF THE ABDOMEN

Passes downwards from the thorax over the abdominal muscles and Poupart's ligament to the thigh. In the median line it passes off the pubes

upon the penis, forming its suspensory ligament, and in the female it descends into the labia. In the male it passes on each side round the spermatic cord into the scrotum, and becomes continuous with the fascia of the perineum. After having passed over Poupart's ligament it forms envelopes for the inguinal glands, and adheres to the fascia lata, presenting a cribriform appearance (*vide* Fascia lata); and continuing its course downwards, becomes identified with the subcutaneous cellular tissue of the lower extremity.

FASCIA TRANSVERSALIS AND FASCIA ILIACA.

The *fascia transversalis* is placed between the transversalis muscle and the peritoneum; it is very strong inferiorly, and is connected to the internal lip of the ilium and to the whole length of Poupart's ligament, and is continuous, behind the rectus muscle, with the fascia of the opposite side. As the external iliac vessels are passing beneath Poupart's ligament, a prolongation of this fascia extends along the anterior aspect of their sheath, and becomes identified with the cribriform fascia in the groin. The spermatic cord in the male, and the round ligament in the female, pass through a foramen in this fascia about half an inch above Poupart's ligament, and midway between the spine of the ilium and the symphysis pubis; this opening

is the *internal abdominal ring*; from its margin is prolonged over the cord a funnel-shaped process, called the *infundibuliform fascia*.

The *fascia iliaca* is much stronger than the *fascia transversalis*; it is connected to the inner lip of the ilium, passes over the *iliacus internus* muscle, adheres to Poupart's ligament, from which it passes behind the sheath of the femoral vessels into the thigh, and is connected with the capsule of the hip-joint and the pubic portion of the *fascia lata*. The processes of *fascia transversalis* and *fascia iliaca*, passing one in front and the other behind the femoral vessels, and uniting at the outer and inner border, form the sheath of the vessels. The *fascia propria* of a femoral hernia is formed by the sub-serous cellular tissue of the peritoneum extended over the upper opening of the femoral ring (*septum crurale*), and by the sheath of the vessels here described. The *fascia iliaca* continued into the pelvis is continuous with the *pelvic fascia*; this lines the parietes of this cavity as far as the upper origin of the levator ani muscle, where it divides into two layers; one layer, the outer, called the *obturator fascia*, descends between the obturator internus muscle and the levator ani, and is attached to the great sciatic ligament, the tuberosity of the ischium, and pubes. The *internal* layer of the pelvic fascia, called also *recto-vesical fascia*, passes downwards along the inner surface of the levator

ani muscle to the inferior margin of the symphysis pubis, from which it is reflected on the prostate gland and neck of the bladder, forming the *anterior true ligaments* of the bladder, and laterally it is reflected on the sides of this viscus, forming its *lateral true ligaments*, and another prolongation forms the capsule of the vesiculæ seminales.

SUPERFICIAL PERINEAL FASCIA

Adheres to the rami of the ischium and pubes of either side, and extends across the perineum, being continuous anteriorly with the superficial fascia of the scrotum derived from the superficial fascia of the abdomen.

TRIANGULAR LIGAMENT OF THE URETHRA.

The triangular ligament between the rami of the pubes is an interosseous ligament, like the membrane filling up the obturator foramen; it is connected on either side, to the rami of the ischium and pubes, its base looking towards the rectum, its apex towards the subpubic ligament; it is pierced by the membranous portion of the urethra, which passes through the ligament about three-quarters of an inch below the pubes. It consists of two layers, between which are situated the division of the pudic artery, Cowper's glands, and the compressor

urethræ; one layer (*the anterior*) is expanded on the bulb, keeping that body in its situation; the other (*the posterior*) is continued along the membranous portion of the urethra to the prostate gland, forms its capsule, and becomes continuous on the bladder with the vesical layer of the fascia pelvica. The ligament is sometimes called the deep perineal fascia, but this term should properly be applied to a layer of fascia extended over the deep muscles of the perineum. Urine, when it escapes from the urethra, lies under the superficial fascia, and makes its way into the scrotum. It cannot make its way into the thigh, on account of the attachment of the superficial fascia to the rami of the ischia and pubes. The triangular ligament extends for a very little distance below the urethra. In the female it is smaller than in the male.

FASCIA OF UPPER EXTREMITY

Consists of tendinous fibres, which are stronger in some situations than others; it invests the entire arm, and sends partitions between the several muscles. It takes its origin superiorly from the spine of the scapula, adheres to the condyles of the humerus, and to the ridges which lead to them; passes from thence on the forearm, where it is very strong, particularly at its posterior part, and, binding down the several muscles, reaches the

wrist-joint, to the angular ligaments of which it is connected.

The *palmar fascia*, of triangular form, is very strong, and takes its origin from the anterior annular ligament; from this it expands over the palm, and near the fingers divides into four fasciculi, each of which is forked, and inserted into either side of the sheaths of the flexor tendons, and into the ligaments of the first phalanges.

FASCIA LATA.

The fascia lata takes its origin from the crest of the ilium, the spines of the sacrum, the os coccygis, Poupart's ligament, the tuberosity of the ischium, and the rami of the ischium and pubes. From this extensive connexion it extends down the thigh, confining the different muscles in their situation, and also sending partitions between them. At the posterior part of the thigh it adheres intimately to the linea aspera, and at the knee-joint to the condyles of the femur and the capsular ligament; it is then continued over the heads of the tibia and fibula, to which it adheres, and forms the fascia of the leg.

Upon the anterior and upper part of the thigh, the fascia lata, from its special arrangement, has been divided into the iliac and pubic portions, and about an inch and a half below Poupart's ligament,

and between the iliac and pubic portions, it presents the opening for the saphena vein. This opening is semilunar, the concavity being directed towards Poupart's ligament; it presents an internal and external cornu, and its edge, turning inwards on itself, becomes continuous with the sheath of the femoral vessels.

The *pubic portion* of the fascia lata covers the pectineus muscle, adheres to the spine of the pubes and the linea ilio-pectinea, passes behind the sheath of the femoral vessels, and becomes continuous with the fascia iliaca.

The *iliac portion* of the fascia lata covers the sartorius, tensor vaginæ femoris, rectus, and iliac muscles, and presents towards the pubic portion a *crescentic* or *falciform edge*, the aspect of which is directed downwards and inwards; the inferior cornu of this edge is continuous with the outer cornu of the saphenic opening, and its superior cornu extends along Poupart's ligament, crosses the femoral vessels, and is inserted into Gimbernat's ligament, and the linea ilio-pectinea; the upper part of the falciform edge is called Hey's ligament.

The *cribriform fascia*.—The superficial fascia, in passing over Poupart's ligament to the groin, adheres to the crescentic edge of the fascia lata, and to the edge of the saphenous opening, and is attached to that layer of the fascia transversalis which passes anterior to the sheath of the femoral

vessels; this portion of the superficial fascia is perforated by numerous small blood-vessels, and by the anterior superficial absorbents of the limb, which gives it, when dissected, a cribriform appearance, from which it derives its name.

The *fascia of the leg* adheres to the heads of the tibia and fibula, and to the spine of the tibia, to the annular ligaments of the ankle-joint, and to the malleoli; it binds down the muscles, sends partitions between them, which pass from its posterior surface to the bones of the leg and interosseous membrane, and from the anterior annular ligament it is continued then upon the dorsum of the foot.

The *plantar fascia* is very strong, and arises from the under aspect of the os calcis, is attached to the sides of tarsus and metatarsus, and sends two processes between the muscles of the sole of the foot dividing them into an internal, a middle, and an external set. At the base of the toes it divides into five portions, each of which bifurcates, and is inserted by two fasciculi into the lateral ligaments of the joints, and into the sheaths of the flexor tendons. This fascia is strengthened by transverse fibres.

MUSCLES.

HEAD.

Occipito-frontalis.—*origin*, external two-thirds of superior curved line of occipital bone, and posterior external part of mastoid process of temporal bone. *Insertion*, integuments of eyebrows, where the fibres become blended with those of the pyramidalis nasi, the corrugator supercilii, and the orbicularis palpebrarum. *N.* facial and sometimes also by small occipital.

MUSCLES OF EXTERNAL EAR.

Attollens aurem.—*O.* aponeurosis of occipito-frontalis above external ear. *I.* upper and anterior part of cartilage of ear. *N.* small occipital.

Attrahens aurem.—*O.* lateral part of cranial aponeurosis. *I.* anterior part of helix. *N.* facial.

Retrahens aurem.—*O.* mastoid process. *I.* back part of concha. *N.* facial.

FACE.

Orbicularis palpebrarum.—*O.* internal angular process of frontal bone and upper edge of tendo oculi. It surrounds the orbit. *I.* nasal process of superior maxillary bone and inferior edge of tendo oculi. *N.* facial.

Tensor tarsi.—*O.* edge of lachrymal bone. *I.*

tarsal cartilages as far as puncta lachrymalia. *N. facial.*

Corrugator supercilii.—*O.* superciliary ridge of frontal bone. *I.* middle of eyebrow, beneath orbicularis muscle.* *N. facial.*

Pyramidalis nasi.—*O.* occipito-frontalis muscle, descends along nasal bones, *I.* compressor nasi muscle. *N. facial.*

Compressor nasi.—*O.* canine fossa in superior maxilla. *I.* dorsum of nose. *N. facial.*

Levator labii superioris alæque nasi.—*O.* upper extremity of nasal process of superior maxilla, and from edge of orbit above infra-orbital foramina. *I.* side of the ala of the nose and upper lip. *N. facial.*

Zygomaticus minor.—*O.* upper part of malar bone. *I.* upper lip, near commissure. Sometimes wanting. *N. facial.*

Zygomaticus major.—*O.* lower part of malar bone, near zygomatic suture. *I.* angle of mouth. *N. facial.*

Levator anguli oris.—*O.* canine fossa above alveolus of first molar tooth. *I.* commissure of lips, and orbicularis oris. *N. facial.*

Levator labii superioris.—*O.* orbital border of superior maxillary and malar bones. *I.* upper lip. *N. facial.*

Depressor labii superioris alæque nasi.—*O.* myrtiform fossa above canine and incisor teeth of supe-

rior maxilla. *I.* integuments of upper lip and fibrocartilage of septum and ala nasi. *N.* facial.

Depressor anguli oris.—*O.* external oblique line on lower jaw, extending from anterior edge of masseter muscle to mental foramen. *I.* commissure of lips. *N.* facial.

Depressor labii inferioris.—*O.* side and front of lower maxilla, above its base. *I.* half of lower lip and orbicularis oris. *N.* facial.

Levator labii inferioris.—*O.* alveoli of incisor teeth, lower jaw. *I.* integuments of chin. *N.* facial.

Orbicularis oris, surrounds mouth by two fleshy fasciculi. *N.* facial.

Dilatator naris posterior.—*O.* from margin of nasal notch of superior maxilla. *I.* skin of margin of nostril. *N.* facial.

Dilatator naris anterior.—*O.* cartilage of ala of nostril. *I.* margins of nostril. *N.* facial.

Compressor narium minor.—*O.* cartilage of ala. *I.* skin of tip of nose. *N.* facial.

Buccinator.—*O.* three last alveoli of superior maxilla and external surface of posterior alveoli of lower maxilla, and from a ligament (pterygo-maxillary) which extends from the hamular process of the sphenoid bone to the extremity of the mylo-hyoid ridge of the inferior maxilla. *I.* commissure of lips. *N.* facial.

Risorius.—*O.* fascia over masseter. *I.* angle of mouth. *N.* facial.

MUSCLES OF LOWER JAW.

Masseter, consists of two portions: *Anterior portion*, *O.* superior maxilla, where it joins malar bone, and inferior edge of latter. *I.* outer surface of angle of lower jaw. *Posterior portion*, *O.* edge of malar bone and zygomatic arch, as far as glenoid cavity. *I.* ramus of lower jaw, and coronoid process. *N.* inferior maxillary.

Temporal.—*O.* side of cranium, beneath semi-circular ridge on parietal bone, temporal fossa, and aponeurosis. *I.* coronoid process of inferior maxilla to last molar tooth. *N.* inferior maxillary.

Pterygoideus internus.—*O.* inner side of external pterygoid plate and tuberosity of palate bone. *I.* inner side of angle of jaw and rough surface above. *N.* inferior maxillary.

Pterygoideus externus.—*O.* outer side of external pterygoid plate, crest on great ala of sphenoid bone and tuberosity of superior maxilla. *I.* anterior and internal part of neck of lower jaw, inter-articular cartilage, and inferior synovial membrane. *N.* inferior maxillary.

MUSCLES OF ANTERIOR AND LATERAL PARTS
OF NECK.

Platysma myoides.—*O.* fascia covering upper and outer part of deltoid, great pectoral, and tra-

pezius muscles. *I.* chin, lower jaw, and fascia covering parotid gland. Some of the fibres become blended with those of the depressor labii inferioris and anguli oris. *N.* facial and superficial cervical.

Sterno-cleido mastoideus.—*O.* upper and anterior part of first bone of sternum and sternal third sometimes half, of clavicle. *I.* upper part of mastoid process and external third of superior curved line of occipital bone. *N.* spinal accessory and cervical plexus.

Sterno-hyoideus.—*O.* posterior surface of first bone of sternum, cartilage of first rib, sternal end of clavicle and sterno-clavicular ligament. *I.* lower border of body of os hyoides. *N.* descendens noni.

Sterno-thyroideus.—*O.* posterior surface of first bone of sternum and cartilage of first rib. *I.* oblique line on ala of thyroid cartilage. It is broader than the preceding. *N.* descendens noni.

Omo-hyoideus.—*O.* behind transverse notch in scapula, from the ligament which passes over the notch. *I.* lower border of os hyoides, at the junction of its body and great cornu. It is a double-bellied muscle, the mesial tendon being bound down by a pulley of cervical fascia. *N.* descendens noni.

Digastricus.—A double-bellied muscle. Poste.

rior belly, *O.* groove internal to mastoid process. Anterior belly, *O.* rough depression on inner surface of base of jaw near its symphysis. The two bellies unite, at an angle, in a tendon which passes through the fibres of the stylo-hyoid muscle, and is attached to the os hyoides by aponeurosis. *N.* anterior belly by mylo-hyoidean, posterior belly by facial.

Mylo-hyoideus.—*O.* mylo-hyoid ridge of inferior maxilla. *I.* base of os hyoides, and middle tendinous raphé common to it and its fellow. *N.* mylo-hyoidean.

Genio-hyoideus.—*O.* inner side of symphysis of lower maxilla above digastricus. *I.* base of hyoid bone. *N.* hypoglossal.

Hyo-glossus.—*O.* greater and lesser cornua, and part of body of os hyoides. *I.* side of tongue. This muscle is sometimes described as three, the basio-glossus, cerato-glossus, and chondro-glossus. *N.* hypoglossal.

Genio-hyo-glossus.—*O.* superior genial tubercle on symphysis. *I.* mesial line of tongue from apex to base, and body and lesser cornu of hyoid bone. *N.* hypoglossal.

Lingualis, consists of fasciculi of fibres running from apex to base of tongue, and lying between the genio-hyo-glossus and the hyo-glossus. *N.* hypoglossal and chorda tympani.

Stylo-hyoideus.—*O.* outer side of styloid process

near its middle. *I.* cornu and body of os hyoides. *N.* facial.

Stylo-glossus.—*O.* styloid process, near its tip and the stylo-maxillary ligament. *I.* side of tongue, as far as the tip. *N.* hypoglossal.

Stylo-pharyngeus.—*O.* inner part of base of styloid process. *I.* side of pharynx, and posterior border of thyroid cartilage. *N.* glosso-pharyngeal.

MUSCLES OF THE PHARYNX.

Inferior constrictor.—*O.* side of cricoid cartilage, inferior cornu, and posterior part of ala of thyroid cartilage. *I.* with its fellow, in the median raphé on back of pharynx.

Middle constrictor.—*O.* greater and lesser cornua of os hyoides and stylo-hyoid ligament. *I.* median raphé ~~and basilar process of occipital bone~~.

Superior constrictor.—*O.* hamular process and lower border of internal pterygoid plate; pterygo-maxillary ligament, tuberosity of palate bone, reflected tendon of tensor palati, ~~side of tongue~~ and posterior third of mylo-hyoid ridge. *I.* basilar process of occipital bone and median raphé of pharynx.

These muscles are supplied by the pharyngeal plexus, and external laryngeal nerve.

MUSCLES OF THE PALATE.

Levator palati.—*O.* petrous portion of temporal bone in front of carotid foramen, and from cartilage of Eustachian tube. *I.* broadly into soft palate. *N.* facial nerve through petrosal branches.

Tensor, vel circumflexus palati.—*O.* scaphoid fossa of sphenoid, and front part of Eustachian tube; tendon winds round hamular process. *I.* into hard palate and velum, meeting its fellow in middle line. *N.* from otic ganglion.

Azygos uvulæ.—*O.* posterior nasal spine of palate. *I.* into uvula. *N.* from petrosal nerves.

Palato-glossus.—*O.* inferior surface of soft palate. *I.* side of tongue. *N.* from Meckel's ganglion.

Palato-pharyngeus.—*O.* inferior surface of soft palate. *I.* side and back of pharynx, and side of thyroid cartilage. *N.* from Meckel's ganglion.

LARYNX.

Thyro-hyoideus.—*O.* oblique ridge on ala of thyroid cartilage. *I.* lower border of great cornu, and body of os hyoides. *N.* hypoglossal.

Crico-thyroideus.—*O.* fore part of cricoid cartilage. *I.* lower border of thyroid cartilage. *N.* external laryngeal.

Thyro-arytenoideus.—*O.* posterior surface of thyroid cartilage near its angle. *I.* anterior edge of arytenoid cartilage. *N.* inferior laryngeal.

Crico-arytenoideus lateralis.—*O.* upper edge of side of cricoid cartilage. *I.* base of arytenoid cartilage. *N.* inferior laryngeal.

Crico-arytenoideus posticus.—*O.* depression on posterior surface of cricoid cartilage. *I.* outer side of base of arytenoid cartilage. *N.* inferior laryngeal.

Arytenoideus, fills the interval between arytenoid cartilages, and consists of two arrangements of fibres: *oblique*, run from apex of one cartilage to base of opposite one; *transverse*, are attached to posterior surface of each cartilage. *N.* inferior laryngeal.

DEEP MUSCLES ON ANTERIOR AND LATERAL PARTS OF THE NECK.

Longus colli.—Divided into three portions—vertical and two oblique. Vertical portion:—*O.* bodies of three upper dorsal, and four lower cervical and inter-vertebral fibro-cartilages. *I.* bodies of second, third, and fourth cervical vertebræ. Superior oblique portion:—*O.* anterior tubercles of transverse processes of third, fourth, and fifth cervical vertebræ. *I.* anterior tubercle of atlas. Inferior oblique portion:—*O.* bodies of two upper dorsal. *I.* transverse processes of fifth and sixth cervical vertebræ. *N.* cervical plexus.

Rectus capitis anticus major.—*O.* anterior tubercles of transverse processes of third, fourth, fifth,

and sixth cervical vertebræ. *I.* basilar process of occipital bone. *N.* cervical plexus.

Rectus capitis anticus minor.—*O.* transverse process of atlas. *I.* basilar process of occipital bone. *N.* cervical plexus.

Rectus capitis lateralis.—*O.* transverse process of atlas. *I.* jugular process of occipital bone. *N.* sub-occipital.

Scalenus anticus.—*O.* anterior tubercles of transverse processes of third, fourth, fifth, and sixth cervical vertebræ. *I.* upper surface of first rib between its two grooves. *N.* lower cervical nerves.

Scalenus medius.—*O.* posterior tubercles of transverse processes of six lower cervical vertebræ. *I.* first rib, behind groove for subclavian artery. *N.* lower cervical nerves.

Scalenus posticus.—*O.* posterior tubercles of transverse processes of two or three lower cervical vertebræ. *I.* upper edge of second rib between its tubercle and angle. *N.* lower cervical nerves.

THORAX.

Pectoralis major.—*O.* sternal half of clavicle, anterior surface of sternum, cartilages of all the true ribs except first, and aponeurosis common to it and external oblique muscle. *I.* by a flat tendon into anterior edge of bicipital groove, and by an

aponeurosis into fascia of forearm, and sends up an expansion to the head of the humerus, over the bicipital groove. *N.* external anterior thoracic.

Pectoralis minor.—*O.* third, fourth, and fifth ribs, external to their costal cartilages, and from an aponeurosis over the intercostal muscles. *I.* inner and upper surface of coracoid process of scapula. *N.* internal anterior thoracic.

Subclavius.—*O.* cartilage of first rib. *I.* groove on inferior surface of clavicle. *N.* from fifth and sixth cervical.

Serratus magnus.—*O.* by nine fleshy slips, from eight or nine superior ribs. *I.* base of scapula, *N.* posterior thoracic nerve.

Intercostales are twenty-two in number on each side: eleven *internal* and eleven *external*. The fibres of the external pass obliquely from behind, forwards and downwards; those of the internal in the opposite direction. *N.* intercostals.

External.—*O.* inferior edge of each rib, commencing at transverse processes of vertebræ. *I.* external lip of superior edge of rib beneath, extending to behind costal extremities of cartilages.

Internal.—*O.* at sternum from the inner lip of lower edge of each cartilage and rib as far as angle. *I.* inner lip of superior edge of cartilage and rib beneath.

Levatores costarum.—*O.* extremity of each dorsal transverse process. *I.* upper edge of rib below,

between tubercle and angle. *N.* posterior divisions of dorsal nerves.

Triangularis sterni.—*O.* posterior surface and edge of lower part of sternum and ensiform cartilage. *I.* cartilages of second, third, fourth, and fifth ribs. *N.* intercostals.

MUSCLES OF THE BACK.

First Layer.

Trapezius.—*O.* internal third of superior curved line of occipital bone, ligamentum nuchæ, and spinous processes of last cervical and all dorsal vertebræ. *I.* posterior border of external third of clavicle, acromion process, and superior edge of spine of scapula. *N.* spinal accessory and cervical plexus.

Latissimus dorsi.—*O.* six inferior dorsal spines, and by lumbar fascia from all lumbar spines, from back of sacrum, posterior third of crest of ilium, and from three to four inferior ribs. *I.* into bicipital groove of humerus. *N.* subscapular.

Second Layer.

Rhomboideus minor.—*O.* lower part of ligamentum nuchæ and spinous processes of last cervical and first dorsal. *I.* base of scapula, opposite to its spine. *N.* fifth cervical.

Rhomboideus major.—*O.* four or five superior dorsal spines. *I.* base of scapula from spine to inferior angle. *N.* fifth cervical.

Levator anguli scapulæ.—*O.* posterior tubercles of transverse processes of four superior cervical vertebræ. *I.* base of scapula, between spine and superior angle. *N.* cervical plexus.

Third Layer.

Serratus posticus superior. — *O.* ligamentum nuchæ, and two or three dorsal spines. *I.* second, third, and fourth, and fifth ribs, external to angles. *N.* posterior division of cervical nerves.

Serratus posticus inferior. — *O.* two last dorsal and two superior lumbar spines. *I.* lower edges of four inferior ribs anterior to angles. *N.* external branches of dorsal nerves.

Splenius muscle, flat and oblique, single at its origin; divides at its insertion into two portions, the splenius colli and splenius capitis; the former attached to the cervical vertebræ, the latter to the cranium. *O.* from spines of five superior dorsal and last cervical vertebræ, and from ligamentum nuchæ as high as the third cervical vertebra. *I.* the lower portion, splenius colli, the smaller, into posterior tubercles of transverse processes of three or four superior cervical vertebræ. Upper portion, splenius capitis, into posterior part of mastoid pro-

cess, superior curved ridge of occipital bone, and the rough surface below it. *N.* posterior divisions of cervical nerves.

Fourth Layer.

The following muscles lie beneath the serrati, and a fascia called the vertebral aponeurosis. The fleshy mass occupying the vertebral grooves of either side is called erector spinæ, and it divides opposite the last rib into two portions, sacro-lumbalis, and longissimus dorsi.

Erector spinæ.—*O.* from a dense fascia connected with the spines of the sacrum, from the posterior third of the crista of the ilium, from the posterior surface of the sacrum, and from the great sacro-sciatic ligament. The outer portion, called the sacro-lumbalis, is inserted into the angles of six or seven lower ribs. *Musculus accessorius ad sacro-lumbalem*, a continuation of sacro-lumbalis. *O.* angles of six or seven lower ribs, internal to the tendons of preceding muscle. *I.* angles of six upper ribs, and into transverse process of last cervical vertebra. *N.* dorsal and lumbar nerves.

Cervicalis ascendens, the continuation of accessorius into the neck. *O.* from angles of second, third, fourth or fifth upper ribs. *I.* transverse processes of fourth, fifth, and sixth cervical vertebræ.

The inner portion of erector spinæ, *longissimus dorsi*, is inserted into transverse processes of all

the dorsal and lumbar vertebræ, and into all the ribs between their tubercles and angles. *Transversalis colli*, a continuation of the longissimus dorsi. *O.* transverse process of third, fourth, fifth, and sixth dorsal vertebræ. *I.* posterior tubercle of transverse processes of second, third, fourth, fifth, and sixth cervical vertebræ. *N.* dorsal and lumbar nerves.

Trachelo-mastoid, the prolongation of the longissimus dorsi to the head. *O.* transverse processes of four upper dorsal, and four lower cervical vertebræ. *I.* posterior margin of mastoid process. *N.* posterior branches of cervical nerves.

Complexus.—*O.* transverse and articular processes of three or four inferior cervical and three or four superior dorsal vertebræ. *I.* occipital bone, between its two transverse ridges. *N.* posterior branches of the cervical nerves.

Spinalis dorsi.—*O.* spinous processes of two upper lumbar and two last dorsal. *I.* spinous processes of six or eight upper dorsal. *N.* posterior branches of the cervical nerves.

Spinalis colli — *O.* spinous processes of three lower cervical. *I.* spinous process of axis. *N.* posterior branches of the cervical nerves.

Fifth Layer.

Semi-spinalis colli.—*O.* extremities of transverse processes of five or six superior dorsal vertebræ. *I.*

by four heads into spines of second, third, fourth, and fifth cervical vertebræ. *N.* posterior branches of cervical nerves.

Semi-spinalis dorsi.—*O.* by five or six tendons, from transverse processes of dorsal vertebræ, from fifth to eleventh. *I.* extremity of spines of two inferior cervical and three or four superior dorsal vertebræ. *N.* posterior divisions of dorsal nerves.

Multifidus Spinæ.—*N.* first fasciculus arises from spine of vertebra dentata, and is inserted into transverse process of third, each successively in a similar manner down to the last, which arises from the spine of last lumbar vertebra, and is inserted into transverse process of sacrum. *N.* posterior divisions of sacral, lumbar, dorsal, and cervical nerves.

Rotatores spinæ, eleven in number on each side; in the dorsal region. *O.* back part of transverse process. *I.* into the lamina of the vertebra above. *N.* dorsal nerves.

Inter-spinales, are situated between spinous processes of vertebræ: they are in pairs in the cervical region. *N.* posterior branches of spinal nerves.

Inter-transversales, attached and situated as their name implies. *N.* posterior branches of spinal nerves.

Rectus capitis posticus major.—*O.* spinous process of second vertebra. *I.* inferior transverse

ridge of os occipitis. *N.* sub-occipital and great occipital nerves.

Rectus capitis posticus minor.—*O.* posterior tubercle of atlas. *I.* occipital bone, behind foramen magnum. *N.* sub-occipital.

Obliquus inferior.—*O.* spinous process of second vertebra. *I.* extremity of transverse process of atlas. *N.* sub-occipital.

Obliquus superior.—*O.* upper part of transverse process of atlas. *I.* occipital bone, between its transverse ridges, posterior to mastoid process. *N.* sub-occipital.

UPPER EXTREMITY.

Deltoideus.—*O.* lower edge of spine of scapula, anterior edge of acromion, and external third of clavicle. *I.* rough surface on outer side of humerus, near its centre. *N.* circumflex.

Supra spinatus.—*O.* all scapula above the spine, which forms supra spinous fossa, and from fascia covering muscle. *I.* upper and fore part of great tuberosity of humerus. *N.* supra-scapular.

Infra spinatus.—*O.* inferior surface of spine and dorsum of scapula beneath, except near the neck, as low down as posterior ridge on inferior costa. *I.* middle of great tuberosity of humerus. *N.* supra-scapular.

Teres minor.—*O.* depression between the two ridges on inferior costa of scapula, from fascia

covering it, and ligamentous septa. *I.* inferior depression on great tuberosity of humerus. *N.* circumflex.

Subscapularis.—*O.* all the surface and circumference of subscapular fossa. *I.* lesser tubercle of humerus, and a small portion of the neck of the bone. *N.* short subscapular.

Teres major.—*O.* rough surface on inferior angle of scapula, below infra-spinatus. *I.* posterior edge of bicipital groove. *N.* middle subscapular.

Coraco brachialis.—*O.* coracoid process and tendon of short head of biceps. *I.* internal side of humerus about its middle, and, by an aponeurosis, into ridge leading to internal condyle. *N.* musculo-cutaneous.

Biceps.—*O.* short head, from coracoid process; long head, from upper edge of glenoid cavity. *I.* back part of tubercle of radius. *N.* musculo-cutaneous.

Brachialis anticus.—*O.* centre of humerus by two slips on either side of insertion of deltoid, and fore part of humerus to its condyles. *I.* coronoid process of ulna and rough surface beneath. *N.* musculo-cutaneous and musculo-spiral.

Triceps extensor cubiti.—*O.* long head, from lower part of neck of scapula and inferior costa. Second head, from ridge on humerus, below insertion of teres minor. Third head, from ridge below insertion of teres major, leading to the internal

condyle, and from internal intermuscular septum.
I. olecranon process of ulna, and fascia of forearm.
N. musculo-spiral.

Subanconeus.—*O.* few fleshy fibres from humerus above olecranon fossa. *I.* posterior ligament of elbow. *N.* musculo-spinal.

Forearm and Hand.

Pronator radii teres.—*O.* anterior part of internal condyle, fascia of forearm, inter-muscular septa, and, by a small slip, separated from the larger head by the median nerve, from coronoid process of ulna. *I.* outer and back part of radius, about its centre. *N.* median.

Flexor carpi radialis.—*O.* inner condyle and inter-muscular septa. *I.* base of metacarpal bone of index finger. *N.* median.

Palmaris longus.—*O.* inner condyle and fascia of forearm, and inter-muscular septa. *I.* annular ligament and palmar aponeurosis, near root of thumb. *N.* median.

Flexor carpi ulnaris.—*O.* inner condyle, inner side of olecranon, a tendinous band between these points, under which passes the ulnar nerve, inner edge of nearly whole length of ulna, and fascia of forearm. *I.* os pisiforme and base of fifth metacarpal bone. *N.* ulnar.

Flexor digitorum sublimis.—*O.* inner condyle,

internal lateral ligament, coronoid process, and radius below tubercle. *I.* anterior part of second phalanges of each finger. *N.* median.

Flexor digitorum profundus.—*O.* upper three-fourths of anterior surface of ulna by two heads, which embrace the insertion of the brachialis anticus, internal half of interosseous ligament, and from an aponeurosis attached to the posterior border of ulna. *I.* last phalanx of each finger. *N.* ulnar and anterior interosseous.

Flexor longus pollicis.—*O.* fore part of radius below the tubercle, from interosseous membrane to within two inches of carpus, and from coronoid process. *I.* last phalanx of thumb. *N.* anterior interosseous.

Pronator quadratus.—*O.* inferior fifth of anterior surface of ulna. *I.* anterior part of inferior fourth of radius. *N.* anterior interosseous.

Supinator radii longus.—*O.* external ridge of humerus, to within two inches of outer condyle, and from inter-muscular septum. *I.* rough surface on the outside of radius, near its styloid process. *N.* musculo-spiral.

Extensor carpi radialis longior.—*O.* ridge of humerus, between supinator longus and external condyle. *I.* dorsal aspect of carpal end of metacarpal bone of index finger. *N.* musculo-spiral.

Extensor carpi radialis brevior.—*O.* inferior and posterior part of external condyle, external lateral

ligament, and inter-muscular septa. *I.* carpal end of third metacarpal bone. *N.* posterior interosseous.

Extensor digitorum communis. — *O.* external condyle, fascia of forearm and its inter-muscular septa. *I.* posterior aspect of the second and third phalanges of four fingers. *N.* posterior interosseous.

Extensor minimi digiti. — *O.* in common with, and between extensor digitorum communis and extensor carpi ulnaris. *I.* posterior part of phalanges of little finger. *N.* posterior interosseous.

Extensor carpi ulnaris. — *O.* external condyle, fascia, and septa, and middle third of ulna. *I.* carpal end of the fifth metacarpal bone. *N.* posterior interosseous.

Anconeus. — *O.* posterior and inferior part of external condyle and lateral ligament. *I.* external surface of olecranon, and superior fifth of posterior surface of ulna. *N.* musculo-spiral.

Supinator radii brevis. — *O.* external condyle, external lateral, and orbicular ligaments, and from a ridge on outer side of ulna, which commences below its lesser sigmoid cavity. *I.* upper third of external and anterior surface of radius, from above its tubercle to the insertion of pronator radii teres. *N.* posterior interosseous.

Extensor ossis metacarpi pollicis, lies immediately below the border of the supinator radii brevis.

O. middle of posterior part of ulna, interosseous membrane, and posterior surface of radius. *I.* base of metacarpal bone of thumb. *N.* posterior interosseous.

Extensor primi internodii pollicis.—*O.* interosseous membrane, radius, and occasionally a small portion of the ulna. *I.* base of first phalanx of thumb. *N.* posterior interosseous.

Extensor secundi internodii pollicis.—*O.* posterior surface of ulna, above its centre, and from interosseous membrane. *I.* base of last phalanx of thumb. *N.* posterior interosseous.

Extensor indicis.—*O.* middle of posterior surface of ulna, and interosseous membrane. *I.* second and third phalanges of index finger, uniting with the tendon of the common extensor. *N.* posterior interosseous.

Abductor pollicis.—*O.* anterior surface of annular ligament and os trapezium. *I.* outside of base of first phalanx, and by an expansion into both phalanges. *N.* median.

Opponens pollicis.—*O.* annular ligament and os trapezium. *I.* metacarpal bone of thumb. *N.* median.

Flexor pollicis brevis.—*O.* external head, from inside of annular ligament and trapezium and sheath of the flexor carpi radialis. *I.* external sesamoid bone and base of first phalanx of thumb. *Internal head:* *O.* from os trapezoides, os magnum

and base of metacarpal bone of middle finger. *I.* internal sesamoid bone and base of first phalanx. *N.* median and ulnar.

Adductor pollicis.—*O.* three-fourths of anterior surface of the third metacarpal bone. *I.* inner side of base of first phalanx of thumb. *N.* ulnar.

Abductor indicis.—*O.* metacarpal bone of forefinger, and one-half of that of the thumb. *I.* outer side of base of first phalanx. The radial artery passes between its two heads. This is also called the first dorsal interosseous muscle. *N.* ulnar.

Lumbricales.—Four in number. *O.* radial side of the tendons of flexor profundus, near the carpus, a little beyond annular ligament. *I.* middle of first phalanx into tendinous expansion covering the back of each finger. *N.* median and ulnar.

Palmaris brevis, lies between the skin and the palmar fascia. *O.* annular ligament and palmar fascia. *I.* integument on inner side of palm. *N.* ulnar.

Abductor minimi digiti.—*O.* annular ligament and os pisiforme. *I.* ulnar side of first phalanx. *N.* ulnar.

Flexor brevis minimi digiti.—*O.* annular ligament and unciform bone. *I.* base of first phalanx of little finger. *N.* ulnar.

Opponens minimi digiti.—Internal to last, and overlapped by it. *O.* unciform bone and annular

ligament. *I.* all the metacarpal bone of little finger. *N.* ulnar.

Interossei palmares, three in number, are adductors towards the middle finger. *O.* sides of metacarpal bones. *N.* first phalanges and tendinous expansion covering the dorsum of each finger.

1st, arises from ulnar side of second metacarpal bone; 2nd, arises from radial side of fourth metacarpal bone; 3rd, arises from radial side of fifth metacarpal bone; each, joining with the tendons of common extensor, is inserted into the base of the first phalanx of the corresponding finger. *N.* ulnar.

Interossei dorsales, four in number, are abductors from the middle line of the middle finger. *O.* opposed sides of two metacarpal bones. *N.* base of first phalanx of each finger and posterior tendinous expansion.

1st, has been already described under the name of abductor indicis.

2nd, arises from second and third metacarpal bones, inserted into radial side of base of first phalanx of middle finger.

3rd, arises from third and fourth metacarpal bones inserted into ulnar side of base of first phalanx of middle finger.

4th, arises from fourth and fifth metacarpal bones, inserted into ulnar side of base of first phalanx of ring finger. *N.* ulnar.

ABDOMEN.

Obliquus externus vel descendens.—*O.* external surfaces of eight inferior ribs at a little distance from their cartilages. *I.* the fibres end in a broad aponeurosis, inserted into ensiform cartilage, linea alba, os pubis, Poupart's ligament, anterior superior spinous process of ilium, and outer edge of anterior half of crista ilii; a triangular opening formed by the separation of the aponeurotic fibres, the inner passing to the symphysis pubes, the outer to the spine of pubes, is called the *external abdominal ring*. *N.* intercostals and first lumbar.

Obliquus internus vel ascendens.—*O.* fascia lumborum, anterior two-thirds of crista ilii, and external half of Poupart's ligament. *I.* cartilages of seven inferior ribs, ensiform cartilage, linea alba, also by conjoined tendon into symphysis and upper edge of pubes, and into linea ilio-pectinea. *N.* intercostals and first lumbar.

Cremaster.—This muscle, formed by the lower fibres of internal oblique, is here described, though a muscle of the testicle. *O.* inner surface of external third of Poupart's ligament, and from lower edge of obliquus internus, and sometimes from transversalis; the fibres pass through the external abdominal ring, forming loops, both in front and behind the spermatic cord. *I.* crest of the pubes. *N.* genito-crural.

Transversalis.—*O.* fascia lumborum, anterior three-fourths of crista ilii, iliac third of Poupart's ligament, and inner side of six inferior ribs. *I.* along with posterior lamina of obliquus internus, into the whole length of linea alba, and upper edge of pubes. *N.* lower intercostals and first lumbar.

Rectus.—*O.* upper and anterior part of pubes. *I.* ensiform cartilage, and cartilages of fifth, sixth, and seventh ribs. *N.* lower intercostals and first lumbar.

Pyramidalis.—*O.* broad from pubes. *I.* linea alba midway to umbilicus; sometimes wanting.

DEEP MUSCLES OF THE ABDOMEN.

Diaphragm, is a thin muscular and aponeurotic septum between the chest and abdomen. *O.* two crura, posterior surface of ensiform cartilage, internal surfaces of cartilages of the six lower ribs, external ligamentum arcuatum, and convex edge of internal ligamentum arcuatum. *I.* central tendon. There are three openings in diaphragm: 1, for aorta; 2, for œsophagus; 3, for vena cava inferior. *N.* phrenic.

Crura of diaphragm.—*O.* right crus, from fore part of bodies of four superior lumbar vertebræ. Left crus from the sides of the two or three superior lumbar vertebræ. *I.* posterior border of, cordiform tendon.

Quadratus lumborum.—*O.* posterior fifth of spine of ilium, and from ilio-lumbar ligament. *I.* extremity of transverse processes of four superior lumbar vertebræ, also inner surface of posterior half of last rib. *N.* intercostals.

Psoas parvus.—*O.* side of last dorsal and first lumbar vertebræ. *I.* linea ilio-pectinea, fascia iliaca, and fascia lata, behind the femoral vessels; sometimes wanting.

Psoas magnus.—*O.* sides of bodies of last dorsal, and from bodies and transverse processes of all the lumbar vertebræ; also from inter-vertebral ligaments. *I.* inferior part of lesser trochanter and ridge below that process. *N.* lumbar nerves.

Iliacus.—*O.* iliac fossa, with inner margin of the crista; two anterior spines of ilium, and intervening notch, base of the sacrum, ilio-lumbar ligament, and capsule of hip-joint. *I.* common tendon with psoas magnus; the inferior fibres are inserted into anterior and inner surface of femur, below trochanter minor. *N.* anterior crural.

MUSCLES OF MALE PERINÆUM.

Sphincter ani.—*O.* ano-coccygeal ligament. *I.* into raphé, superficial fascia, and common central point of perinæum. *N.* pudic.

Sphincter internus, encircles the lower part of rectum. *N.* pudic.

Erector penis.—*O.* inner surface of tuber ischii, and from insertion of great sciatic ligament. *I.* fibrous membrane of crus penis. *N.* pudic.

Accelerator urinæ.—*O.* central tendon and raphé of perinæum. *I.* anterior fibres around body of penis; middle fibres surround the bulb and lower fibres into triangular ligament. *N.* pudic.

Transversalis perinæi.—*O.* inside of tuber ischii. *I.* central tendon of perinæum. *N.* pudic.

Levator ani.—*O.* posterior part of body of pubes, spine of the ischium, and between these points the angle of division of deep pelvic fascia into obturator and vesical. *I.* anterior fibres into central point of perinæum and prostate; middle fibres into side of rectum, posterior fibres into back part of rectum, and os coccygis. *N.* sacral.

Compressor urethræ.—*O.* This muscle is more correctly described as arising by a narrow tendon from the ramus of the pubes on either side, and as terminating in fleshy fibres, which decussate in the mesial line, some passing above, others passing below, the membranous portion of the urethra. *N.* pudic.

Coccygeus.—*O.* inner surface of spine of ischium. *I.* extremity of sacrum and side of coccyx. *N.* sacral.

MUSCLES OF FEMALE PERINÆUM.

Sphincter ani, as in the male.

Levator ani.—*O.* as in the male. *I.* it forms a loop round the vagina, as well as around the urethra and rectum.

Coccygeus, as in the male.

Transversalis perinæi, as in the male.

Erector clitoridis.—*O.* inner surface of tuber ischii, and insertion of great sciatic ligament. *I.* fibrous membrane of crus clitoridis.

Sphincter vaginae, represents the accelerator urinæ in the male, and extends from the clitoris superiorly, around each side of vagina, to central point of perinæum, in front of anus.

MUSCLES OF THE INFERIOR EXTREMITY.

Fore Part and Sides of the Thigh.

Tensor fascia femoris.—*O.* external part of anterior superior spine of ilium. *I.* fascia lata, about three inches below the great trochanter. *N.* gluteal.

Sartorius.—*O.* anterior superior spine of ilium and notch beneath it. *I.* inner side of upper end of tibia, below its tubercle. *N.* middle cutaneous of anterior crural.

Rectus femoris.—*O.* by two strong tendinous heads: the outer from rough surface above the acetabulum; the inner from anterior inferior spine of ilium. *I.* upper edge of patella. *N.* anterior crural.

Vastus externus.—*O.* base and anterior part of great trochanter, outer edge of linea aspera, oblique ridge leading to external condyle, external surface of femur, and fascia lata. *I.* external edge of tendon of rectus, side of patella, and head of tibia. *N.* anterior crural.

Vastus internus.—*O.* base of small trochanter and line leading from it to linea aspera, anterior part of femur, inner edge of linea aspera, and ridge leading to inner condyle. *I.* inner edge of tendon of rectus, patella, and head of tibia. *N.* anterior crural.

Crureus.—*O.* anterior and external part of femur, commencing at linea inter-trochanterica, and extending along three-fourths of the bone, as far outwards as linea aspera. *I.* upper and outer edge of patella. *N.* anterior crural.

The rectus, crureus, and two vasti are sometimes described as one muscle, named quadriceps extensor cruris.

Sub-crureus or *capsularis*.—*O.* inferior fourth of anterior surface of femur. *I.* synovial membrane of knee joint. *N.* anterior crural.

Gracilis.—*O.* lower part of body and ramus of pubes, and part of ascending ramus of ischium, from a surface two inches and a half in length. *I.* superior part of internal surface of tibia. *N.* obturator.

Pectineus.—*O.* pectineal line external to spine of

pubes, and smooth surface of bone in front. *I.* rough ridge leading from lesser trochanter to linea aspera. *N.* anterior crural and obturator.

Adductor Muscles.

1st, adductor longus.—*O.* anterior surface of pubes, between spine and symphysis. *I.* middle third of linea aspera. *N.* obturator.

2nd, adductor brevis.—*O.* anterior inferior surface of pubes, between symphysis and thyroid foramen. *I.* superior third of internal root of linea aspera to three inches below lesser trochanter. *N.* obturator.

3rd, adductor magnus.—*O.* anterior surface of descending ramus of pubes, ramus of ischium, and external border of its tuberosity. *I.* rough ridge leading from great trochanter to linea aspera, linea aspera, and internal condyle of femur. *N.* obturator and great sciatic.

MUSCLES OF HIP.

Gluteus maximus.—*O.* posterior fifth of crista ilii, the rough surface between it, and superior semicircular ridge, posterior ilio-sacral ligaments, lumbar fascia, spines of sacrum, side of coccyx, and great sciatic ligament. *I.* rough ridge leading from great trochanter to linea aspera, upper third of linea aspera, and fascia lata. *N.* small sciatic and gluteal.

On reflecting the gluteus maximus, we bring into view the gluteus medius, pyriformis, gluteal artery and nerve, ischiatic artery, greater and lesser ischiatic nerves, pudic artery and nerve, tendon of the obturator internus, with the gemelli, the quadratus femoris, and coccygeus. Biceps, semi-tendinosus, semi-membranosus, adductor magnus, vastus externus, internal circumflex artery, tuber ischii, great trochanter and its bursa, greater and lesser sacro-sciatic ligaments, and first perforating artery.

Gluteus medius.—*O.* deep surface of fascia, anterior three-fourths of crista ilii, superior semicircular ridge, and surface of ilium. *I.* upper and outer part of great trochanter. *N.* superior gluteal.

Gluteus minimus.—*O.* inferior semicircular ridge on dorsum of ilium, rough surface between it and edge of acetabulum. *I.* upper and anterior part of great trochanter. *N.* superior gluteal.

Pyriformis.—*O.* concave aspect of second, third, and fourth divisions of sacrum, upper and back part of ilium, and anterior surface of great sciatic ligament. *I.* upper part of great trochanter, behind the insertion of gluteus minimus. *N.* sacral plexus.

Gemellus superior.—*O.* spine of ischium. *I.* top of great trochanter. *N.* sacral plexus.

Gemellus inferior.—*O.* upper part of tuber ischii,

and great sciatic ligament. *I.* top of great trochanter. *N.* sacral plexus.

Obturator internus.—*O.* pelvic surface of obturator membrane, circumference of obturator foramen, and obturator fascia. *I.* top of great trochanter. *N.* sacral plexus.

Quadratus femoris.—*O.* external surface of tuber ischii. *I.* linea quadrata, or line leading from great trochanter to linea aspera, above the insertion of adductor magnus. *N.* sacral plexus.

Obturator externus.—*O.* inferior surface of obturator membrane and surrounding surfaces of pubes and ischium. *I.* trochanteric fossa. *N.* obturator.

MUSCLES ON BACK PART OF THIGH.

Biceps.—*Long head*: *O.* outer and back part of tuber ischii, by a tendon common to it and to the semi-tendinosus. *Short head*: *O.* linea aspera, from below insertion of gluteus maximus to within two inches of external condyle. *I.* head of fibula. *N.* great sciatic.

Semi-tendinosus.—*O.* tuberosity of ischium, and from three inches of the tendon of the long head of biceps. *I.* inner surface of tibia, below tuberosity. *N.* great sciatic.

Semi-membranosus.—*O.* upper and outer part of tuber ischii. *I.* inserted by three portions: 1st, into head of tibia, the tendon passing under inter-

nal lateral ligament; 2nd, into the fascia covering the popliteus muscle; 3rd, into external condyle of femur, crossing the knee-joint, and forming the ligamentum posticum Winslowii. *N.* great sciatic.

MUSCLES ON ANTERIOR AND EXTERNAL PART OF LEG.

Tibialis anticus.—*O.* outer part of superior two-thirds of tibia, inner half of interosseous ligament, fascia of leg, and intermuscular septa. *I.* inner side of internal cuneiform bone, and base of first metatarsal bone. *N.* anterior tibial.

Extensor digitorum longus.—*O.* external part of head of tibia, head and upper three-fourths of fibula, part of interosseous ligament, fascia of leg, and intermuscular septa. *I.* last phalanges of four outer toes. *N.* anterior tibial.

Peroneus tertius.—*O.* anterior surface of lower third of fibula. *I.* base of fifth metatarsal bone. *N.* anterior tibial.

Extensor proprius pollicis.—*O.* inner edge of middle third of fibula, interosseous ligament, and lower part of tibia. *I.* base of last phalange of great toe. It has a special pulley beneath annular ligament. *N.* anterior tibial.

Extensor brevis digitorum.—*O.* upper and anterior part of os calcis calcaneo-astragaloid, and annular ligaments. *I.* internal tendon into base of

first phalanx of great toe ; the three others join the fibular sides of corresponding tendons of extensor digitorum longus. *N.* anterior tibial.

MUSCLES ON OUTER PART OF LEG.

Peroneus longus.—*O.* upper two-thirds of outer surface of fibula, fascia of leg, and intermuscular septa. *I.* tendon passes in a groove in os cuboides obliquely across the sole of the foot, to become attached to the tarsal end of metatarsal bone of great toe. *N.* musculo-cutaneous.

Peroneus brevis.—*O.* outer and back part of lower half of fibular and intermuscular septa. *I.* base of metatarsal bone of little toe. *N.* musculo-cutaneous.

MUSCLES OF BACK OF LEG.

Superficial Layer.

Gastrocnemius. — *O.* *internal head*, upper and back part of internal condyle of femur, and oblique ridge above it ; *external head*, from above external condyle. *I.* lower and back part of os calcis. *N.* internal popliteal.

Plantaris.—*O.* back part of femur above external condyle, and posterior ligament of knee. *I.* posterior part of os calcis. *N.* internal popliteal.

Soleus. — *O.* *external head*, from back part of

head and superior third of fibula: *internal head*, from middle third of tibia, below insertion of popliteus, and from a tendinous arch extending between the bones over the posterior tibial vessels: unites with gastrocnemius to form tendo-Achillis. *I.* lower and back part of os calcis. *N.* internal popliteal.

Popliteus.—*O.* depression on outer condyle of femur. *I.* flat, triangular surface occupying the superior posterior fifth of tibia. *N.* internal popliteal.

Flexor longus digitorum.—*O.* posterior flat surface of tibia, from below popliteus to within three inches of ankle, fascia, and intermuscular septa. *I.* last phalanges of four outer toes. *N.* posterior tibial.

Tibialis posticus.—*O.* posterior internal part of fibula, upper part of tibia, and nearly whole length of interosseous membrane. *I.* inferior and internal tuberosity on scaphoid, internal cuneiform and cuboid bones, and second and third metatarsal bones. *N.* posterior tibial.

Flexor longus pollicis.—*O.* two inferior thirds of fibula, interosseous membrane, and intermuscular septa. *I.* last phalanx of great toe. *N.* posterior tibial.

MUSCLES OF FOOT.

First Layer.

Abductor pollicis.—*O.* lower and inner part of os calcis, internal annular ligament, plantar fascia, and intermuscular septum. *I.* internal side of

base of first phalanx of great toe; there is a sesamoid bone in the tendon. *N.* internal plantar.

Flexor brevis digitorum perforatus.—*O.* inferior and internal part of os calcis, plantar fascia, and intermuscular septa. *I.* second phalanges of four outer toes. *N.* internal plantar.

Abductor minimi digiti.—*O.* outer side of os calcis, ligament extending from os calcis to outer side of fifth metatarsal bone, plantar fascia, and external intermuscular septum. *I.* outer side of base of first phalanx of little toe. *N.* external plantar.

Second Layer.

Flexor accessorius.—*O.* by two heads, one muscular from inner part of os calcis, the other tendinous from outer side of os calcis. *I.* outer part of tendon of flexor longus digitorum. *N.* external plantar.

Lumbricales.—Four in number. *O.* tendons of flexor longus digitorum. *I.* internal side of first phalanges of four lesser toes. *N.* external plantar to two outer, internal plantar to two inner. Between the flexor brevis and flexor accessorius lie the external plantar vessels and nerves.

Third Layer.

Flexor brevis pollicis.—*O.* by a pointed process from inner borders of os cuboides, from external

cuneiform bone, and from the tendon of tibialis posticus. *I.* by two divisions into outer and inner border of base of first phalanx of great toe: the tendons contain sesamoid bones. *N.* internal plantar.

Adductor pollicis.—*O.* os cuboides, base of second, third, and fourth metatarsal bones and sheath of peroneus longus. *I.* base of first phalanx of great toe. *N.* external plantar.

Transversalis pedis.—*A* narrow fasciculus stretched beneath the digital extremities of the metatarsal bones. *N.* external plantar.

Flexor brevis minimi digiti.—*O.* fifth metatarsal bones, and sheath of tendon of peroneus longus. *I.* inner side of base of first phalanx of little toe. *N.* external plantar.

Fourth Layer.

Seven interossei muscles. Three on sole of foot, and four upon its dorsum.

Inferiores, vel plantares.

1st. *O.* inner side of third metatarsal bone. *I.* base of first phalanx of the same toe.

2nd. *O.* inner side of fourth metatarsal bone. *I.* inner side of first phalanx of the same toe.

3rd. *O.* fifth metatarsal bone. *I.* inner side of base of first phalanx of little toe.

Superiores, vel dorsales; they arise by two heads

from the contiguous surfaces of the metatarsal bones.

1st. *O.* internal side of second metatarsal bone and outer side of first. *I.* inner side of base of first phalanx of second toe.

2nd. *O.* opposite sides of second and third metatarsal bones. *I.* outer side of first phalanx of second toe.

3rd. *O.* opposite sides of third and fourth metatarsal bones. *I.* outer side of first phalanx of middle toe.

4th. *O.* opposite sides of fourth and fifth metatarsal bones. *I.* outer side of first phalanx of fourth toe.

Nerve, external plantar.

THE MUSCLES OF THE ORBIT.

1. *Levator palpebræ superioris*.—*O.* upper edge of foramen opticum. *I.* superior border of upper tarsal cartilage. *N.* third.

2. *Obliquus superior*.—*O.* foramen opticum. *I.* sclerotic coat between superior and external rectus. *N.* fourth.

3. *Obliquus inferior*.—*O.* orbital edge of superior maxillary bone. *I.* sclerotic coat between it and external rectus muscle. *N.* third.

4. *Rectus superior*. }
5. *Rectus inferior*. } *N.* third.

6. *Rectus internus*. N. third.

7. *Rectus externus*. N. sixth.

[All rise round optic foramen, the external rectus being also attached to margin of sphenoidal fissure, near the origin of the superior rectus, and they are inserted into the sclerotic coat about a quarter of an inch behind cornea.]

The third, nasal division of fifth, sixth nerves, and the ophthalmic vein, pass between the two heads of the rectus externus.

MUSCLES OF INTERNAL EAR.

Stapedius.—O. within pyramid. I. neck of stapes. N. facial.

Tensor tympani.—O. canal in petrous portion of temporal bone, above Eustachian tube. I. short process below neck of malleus. N. Meckel's ganglion.

Laxator tympani.—O. spinous process of sphenoid bone and Eustachian tube. I. processus gracilis of malleus. N. tympanic branch of facial.

Muscles occasionally absent:—Zygomaticus minor, palmaris longus, palmaris brevis, pyramidalis, gemellus superior, plantaris, flexor brevis minimi digiti, psoas parvus, and peroneus tertius.

THE BRAIN AND ITS MEMBRANES.

The brain is surrounded by three membranes—the dura mater, arachnoid, and pia mater.

DURA MATER.

A firm dense fibrous membrane, adhering by its outer surface to the bones of the cranium, its inner surface being intimately connected with the arachnoid membrane. It supports the brain, acts as an internal periosteum to the bones of the skull, forms the sinuses, and sends sheaths to the several nerves as they pass through the cranial holes. It sends off the following processes:

Falx cerebri, commences narrow at crista galli, and arches backwards between the lobes of the cerebrum, becoming deeper until it meets the tentorium, with which process it is continuous on each side. Its convex edge corresponds to the median groove of the os frontis, the sagittal edges of the parietal bones, and the upper half of the perpendicular ridge of the occipital bone. The superior longitudinal sinus is in its upper edge, and the inferior longitudinal sinus in its inferior free concave edge.

Tentorium cerebelli, extends in a horizontal and arched manner above the cerebellum and below the posterior part of the cerebrum. Its attached

borders contain the lateral sinuses, and are attached to the transverse ridges of the occipital bone, the inferior posterior angles of the parietal bones, the superior borders of the petrous portion of the temporal bones, and to the clinoid processes of the sphenoid bone.

Falx cerebelli, is attached to the lower half of the perpendicular ridge of the occipital bone, and extends between the lobes of the cerebellum towards the foramen magnum.

The dura mater is supplied with nerves from the fourth, fifth, and eighth cranial nerves, and sympathetic.

SINUSES.

Superior longitudinal sinus, of triangular form, extends along the convex margin of the falx cerebri. It commences by a small vein in the foramen cæcum, and increasing in size as it proceeds backwards, pours its blood into the torcular Herophili. Its interior is crossed by small bands called *chordæ Willisii*, and presents the openings of the veins which course upon the upper surface of the cerebral hemispheres, and a number of small whitish masses called *glandulæ Pacchioni*. Upon the outer surface of the outer wall of the sinus, between it and the cranium, are situated the *glandulæ Pacchioni externæ*.

Inferior longitudinal sinus is very small, runs

along the concave edge of the falx cerebri, and terminates in the straight sinus.

Straight sinus, passes from the termination of the inferior longitudinal sinus downwards and backwards, receiving the blood of the venæ Galeni, and empties itself into the torcular Herophili.

Lateral sinuses, each corresponds to the transverse groove in the occipital bone, the groove in the posterior inferior angle of the parietal bone, the mastoid fossa of the temporal bone, and the groove in the occipital bone on each side of the foramen magnum; it passes through the foramen lacerum posterius and becomes the jugular vein.

Torcular Herophili, corresponds to the centre of the internal occipital protuberance; six sinuses communicate with it—viz., the two lateral, the superior longitudinal, the straight, and the two occipital.

Cavernous sinuses, each extends from the anterior clinoid process to the petrous portion of the temporal bone; and, upon being cut into, presents a cellular appearance. The internal carotid artery, the sixth nerve, and branches of the sympathetic nerve, are found within each, but separated from the blood by the reflected venous lining membrane. In the outer wall of each run the third and fourth nerves, and the first branch of the fifth; the sinus of each side presents the openings of the ophthalmic vein, of the two petrosal sinuses, and of the circular sinus.

Circular sinus, surrounds the pituitary body, and is formed of an anterior and posterior transverse vein, which extends from one cavernous sinus to the other.

Superior petrosal sinuses, each passes from the cavernous sinus along the upper border of the petrous portion of the temporal bone, to the lateral sinus.

Inferior petrosal sinuses, each passes from the cavernous sinus downwards and backwards, along the line of contact of the petrous portion of the temporal bone, and the occipital to the lateral sinus, where this terminates in the internal jugular vein.

Transverse sinus, crosses the basilar process of the occipital bone, and connects the inferior petrosal sinuses.

Occipital sinuses, two in number, are contained in the falx cerebelli, and open into the torcular Herophili. Not infrequently these two join to form a single sinus before opening into the space.

TUNICA ARACHNOIDEA,

Belongs to the class of serous membranes, is spread over the surface of the brain without dipping down into its sulci, and is reflected upon the dura mater, in those situations where the nerves and veins pierce this fibrous membrane: thus,

after the manner of all serous membranes, it forms a shut sac, and consists of a parietal and a visceral layer. Its parietal layer is in contact with the dura mater except at certain places where it forms the subdural cavity ; while the visceral layer is separated from the subjacent pia mater in many positions, forming the subarachnoid space, which is more apparent in some places than in others. Among the most marked is one at the base of the brain, at the inter-peduncular space and the fourth ventricle ; it is at the latter place that the subarachnoid space communicates with the ventricles of the brain through the foramen of Majendie. In the subarachnoid space is contained the cerebrospinal fluid ; and some fluid also exists in the subdural space. This fluid contains 98.5 per cent. of water and 1.5 of animal and saline matters.

Glandulæ Pacchioni, are flattened, pulpy-looking bodies which extrude through the dura mater, and are also found in the longitudinal sinus, and in other situations. They are hypertrophies of the normal villi of the arachnoid.

PIA MATER.

The vascular covering of the brain lines its entire surface, dipping between its convolutions and sending numerous blood-vessels into its substance ; it is intimately connected to the arachnoid membrane

by its outer surface, except at the base and sulci of brain ; and entering the ventricles by the great transverse fissure, forms the velum interpositum and choroid plexuses. It obtains a large nerve supply from the third, sixth, facial, pneumogastric spinal accessory and sympathetic nerves.

THE BRAIN.

The brain is subdivided into four portions—viz., the cerebrum, the cerebellum, the medulla oblongata, and the pons Varolii.

Weight about 49 oz. in the male, and 44 oz. in the female.

THE CEREBRUM.

This, the largest of the four divisions, is of oval form, and is divided into two equal portions, called hemispheres, by a fissure (longitudinal) which extends along the medial line upon its upper surface, and contains the falx cerebri and the anterior cerebral arteries. At the base of the brain the hemispheres are divided at each extremity by this fissure, but in the centre they are united.

Hemispheres, right and left, are convex superiorly and externally, and flat towards each other, where they correspond to the falx ; on the under surface

they rest on the anterior and middle fossa, and the tentorium cerebelli.

*Convolution*s, or *gyri*, are eminences, longitudinal and rounded, and directed in various ways upon the surface of each hemisphere.

Sulci, are the depressions which separate the convolutions from each other, over which the arachnoid membrane passes, but into which the pia mater dips.

Grey matter of brain, is of brownish-grey colour, from three to four lines in thickness, soft and vascular, and for the most part situated upon the outer surface of the brain. It is however found in striæ, and masses in the interior of the brain. In some situations its colour assumes a dark hue, as is seen in a section of the crus cerebri. Microscopic examination shows that it is composed of cells containing nuclei and granules; hence it is sometimes called "vesicular matter."

Medullary substance, white and fibrous, forms the greater part of the brain.

Lobes, are five in number: *frontal*, *parietal*, *occipital*, *temporo-sphenoidal*, and *central* or *island of Reil*. The first three correspond fairly with the bones beneath which they are placed; the temporo-sphenoidal occupies the middle fossa, the central is found in the fissure of Sylvius.

Primary fissures: *fissure of Sylvius* begins at the base of the brain, and corresponds to the lesser

wing of the sphenoid bone. It shortly divides into two rami, an ascending, about an inch in length, and a posterior, which runs horizontally backwards, separating the parietal from the temporo-sphenoidal lobes. In angle formed by the two divisions of the fissure is the island of Reil.

Fissure of Rolando passes upwards and backwards, commencing just above the fissure of Sylvius, and ends near the longitudinal fissure. It separates the frontal from the parietal lobes.

Parieto-occipital fissure, seen on the median aspect of the hemisphere, passes downwards and forwards towards the corpus callosum. It passes outwards on the external surface of the brain for about an inch, and separates the parietal and occipital lobes.

Lobes—*frontal lobe* has four convolutions on its outer surface, *superior*, *middle*, and *inferior frontal*, separated by the superior and inferior antero-posterior fissures; and the *ascending frontal* convolution, which is placed in front of the fissure of Rolando. Its orbital surface presents the olfactory and orbital sulci, with the straight convolution between them.

Parietal lobe presents five convolutions, the *ascending parietal*, placed behind the fissure of Rolando, the *superior* and *inferior parietal lobules*, separated by the interparietal fissures; the *supra marginal* and the *angular gyri*.

Occipital lobe has three convolutions, *superior*, *middle*, and *inferior occipital*, separated by the superior and inferior occipital fissures : these gyri are connected with the parietal and temporo-sphenoidal lobes by three or four *annectant gyri*.

Temporo-sphenoidal lobe : composed of three gyri, *superior*, *middle*, and *inferior*, divided by the parallel and the inferior temporo-sphenoidal fissures.

Central lobe, or *island of Reil*, consists of six gyri, and corresponds with the extra-ventricular portion of the corpus striatum. Is found in the fissure of Sylvius.

The inner or median surface of the hemisphere presents the following fissures :—

Parieto-occipital, already described.

Calcarine commences at the back part of the hemisphere, runs forwards, and joins at an acute angle the parieto-occipital fissure.

Calloso-marginal commences below the corpus callosum, courses round its genu, along its upper surface, whence it inclines upwards to end behind the fissure of Rolando : between it and the corpus callosum is the gyrus of the latter.

Convolutions Marginal, runs along the longitudinal fissure.

Gyrus fornicatus, or *convolution of the corpus callosum*, skirts the corpus callosum.

Quadrata, or *præcuneus*, between the calloso-marginal and parieto-occipital fissures.

Cuneus, wedge-shaped, between the parieto-occipital and calcarine fissures.

The under surface of the temporo-sphenoidal and occipital lobes are continuous and present three gyri, *superior occipito-temporal* or *uncinate*, *inferior* and *middle occipito-temporal*: and two fissures, the dentate or hippocampal, and the colateral.

Locus perforatus anticus, is perforated by a number of small foramina, for branches of the anterior choroid arteries; it is situated external to the optic commissure.

Optic commissure, the junction of the two optic tracts in the middle line.

Tuber cinereum, a mass of grey matter behind the optic commissure, to which is attached the *infundibulum*, a hollow, funnel-shaped process of grey matter, which ends in the *pituitary body*.

Corpora albicantia, two rounded masses, which correspond to the turn of the anterior crura of the fornix.

Locus perforatus posticus, is perforated by small apertures, for the passage of arteries to the optic thalami.

Centrum ovale minus, is the section made of the cerebrum within a few lines of the corpus callosum; an oval surface of white matter is seen surrounded by the grey cortical substance.

Centrum ovale majus, a term applied to the sec-

tion which is made by slicing the cerebrum to a level with the corpus callosum.

Corpus callosum, is the white commissure connecting the two hemispheres; it is about four inches in length, and presents upon its upper surface a median groove—the *raphé*—which corresponds to the anterior cerebral arteries, and from which, on each side, pass the connecting transverse fibres of the hemispheres, called *lineæ transversæ*. It unites by its posterior extremity with the fornix and the hippocampus, major and minor; its anterior extremity being curved upon itself, *the genu* turns back; the reflected portion, *the rostrum*, gradually tapers off on each side to form the *peduncles of the corpus callosum*, while the central portion, *the lamina cinerea*, is connected with the optic commissure, and tuber cinereum at the base of the brain.

Lateral ventricles, each consist of a body and three cornua, the body corresponding to the centre of each cerebral hemisphere, the cornua proceeding one to each lobe. The bodies of the ventricles are separated from each other by the septum lucidum.

Anterior horn, passes forwards and outwards in the anterior lobe; in it is seen the corpus striatum.

Middle horn, passes backwards, outwards, downwards, forwards, and inwards in the middle line: in it are seen the hippocampus major, pes accessorius,

corpus fimbriatum, pes hippocampi, choroid plexus, and optic thalamus.

Posterior horn, passes backwards, outwards, and inwards in the posterior lobe; in it are seen the hippocampus minor and pes accessorius.

Septum lucidum, descends from the raphé of the corpus callosum to the fornix, separating the lateral ventricles from each other. It consists of two layers, which are composed of white and of grey matter, and lined by epithelium; the cavity between them is called the *fifth ventricle*; its form is triangular, the apex corresponding to the union of the corpus callosum and the fornix, the base anterior, corresponding to the curved portion of the corpus callosum.

Fornix, a longitudinal white commissure, placed horizontally beneath the septum lucidum and corpus callosum; it arches above the third ventricle, and lies upon the velum interpositum and choroid plexus. Its body is triangular, and from it proceed anteriorly two crura, and posteriorly also two crura: the *anterior crura* descend to the base of the brain, curve upon themselves, forming the corpora albicantia, then pass backwards and are lost in the optic thalamus; the *posterior crura* pass backwards and outwards, become attached to the hippocampi majores, and are lost in the descending cornu.

The lyra is the appearance presented upon the

under aspect of the fornix by some transverse white fibres which connect the hippocampi and the posterior crura of the fornix.

Foramen of Monro is an opening on each side behind the anterior pillars of the fornix, which join in the middle line after passing downwards and inwards, and open into the third ventricle, thus establishing a communication between this and the lateral ventricles.

Corpora striata, two pear-shaped bodies, their bases being contained in the anterior cornua of the lateral ventricles, the narrow stalk-like extremities being directed backwards into the bodies of the ventricles : they are grey on their surface, but when cut into present alternating striæ of grey and white matter ; thus their name.

Optic thalami, two large oval bodies placed behind and between the corpora striata ; each presents upon its inferior surface two tubercles, called *corpora geniculata*. Towards the median line the optic thalami are flat, and united to each other by a soft structure, called soft commissure ; posteriorly they are also joined together by the posterior commissure ; upon their external surface they are white, but their interior is grey.

Tænia semicircularis, a narrow white band, situated in the groove between the optic thalamus and corpus striatum of each side.

Choroid plexus, the fold of pia mater which lies

upon the optic thalamus, and which enters the body of the lateral ventricle by the inferior cornu; the choroid plexus of each side passes forwards and inwards, and both unite in the foramen of Monro.

Velum interpositum, lying underneath the fornix, unites the choroid plexuses of either side; it is composed of arachnoid membrane and pia mater, and contains in its centre the *venæ Galeni*.

Venæ Galeni, contained in the *velum interpositum*, pass from before backwards, and terminate in the straight sinus. These veins return the blood from the choroid plexuses, and from the parts within the ventricles.

Pineal body, a small conical reddish-grey mass, containing in general gritty matter. It is placed upon the corpora quadrigemina, and is connected with the optic thalami by two peduncles.

Hippocampus minor, an oval eminence in the posterior cornu of the lateral ventricle; white externally, and grey in its interior. It is the fold which corresponds to the calcarine fissure.

Hippocampus major, a larger eminence, and placed in the middle cornu of the lateral ventricle.

Pes hippocampi, the tuberculated appearance which the extremity of the hippocampus major presents.

Tænia hippocampi, or *corpus fimbriatum*, the free margin of the posterior crus of the fornix, where it is connected with the hippocampus major.

Corpus dentatum, a grey serrated line in the inferior cornu of the lateral ventricle, and which is exposed upon removing the *tænia hippocampi*, beneath which it lies.

Eminentia collateralis or *pes accessorius* is a triangular smooth surface between the hippocampus major and minor. It corresponds to the posterior ramus of the fissure of Sylvius.

Third ventricle, a deep fissure between the optic thalami, exposed by separating these bodies. It is bounded anteriorly by the descending crura of the fornix, and the anterior commissure, posteriorly by the posterior commissure and the tubercula quadrigemina, laterally by the optic thalami : its floor corresponds to the lamina cinerea, tuber cinereum, infundibulum, corpora albicantia, and locus perforatus posticus ; it is covered in by the velum interpositum and fornix, and is crossed by three commissures, anterior, middle, and posterior.

Iter e tertio ad quartum ventriculum, an opening in the posterior part of the third ventricle, under the posterior commissure and tubercula quadrigemina, and leading obliquely backwards and downwards to the fourth ventricle.

Anterior commissure, a white, round cord, anterior to the crura of the fornix, and passing transversely from one corpus striatum to the other.

Posterior commissure, white, extends transversely from one optic thalamus to the other.

It is shorter and smaller than the anterior commissure.

Middle commissure, grey and soft, connects the anterior parts of the optic thalami.

Corpora quadrigemina, four eminences, called also nates and testes; situated under the posterior part of the velum interpositum, and the pineal body; the two anterior (the nates) are connected to the optic thalami; the posterior (the testes) are connected to the cerebellum by the following processes.

Superior peduncles of the cerebellum, two white plates which pass obliquely from the cerebellum upwards and inwards to the testes.

Corpora geniculata and optic tracts. The tracts are flat bands which arise from the under and outer part of the thalami and corpora quadrigemina: pass forwards round the crus cerebri and decussate at the optic commissure. Two oval masses, *corpus geniculatum externum and internum*, are seen on each side before the optic tract bends forwards.

Valve of Vieussens, a layer of grey and white substance, of triangular form, attached by its sides to the processus e cerebello ad testes, by its base to the cerebellum, and by its apex to the testes.

Fourth ventricle, is exposed by cutting through the valve of Vieussens. It is bounded anteriorly by the pons Varolii, laterally by the processus e cerebello ad testes, superiorly by the valve of Vieus-

sens, inferiorly by pia mater and arachnoid membrane, and posteriorly by the cerebellum.

On the floor of the fourth ventricle runs a longitudinal groove which ends below in the *calamus scriptorius*: on each side is a round eminence, *fasciculus teres*: from the groove emerge several white lines *lineæ transversæ* forming part of the auditory nerve. In front and to outer side of the fasciculus teres, is a bluish spot, *locus cæruleus*. In the posterior part of the floor are nuclei for the glossopharyngeal, vagus, hypoglossal, and spinal accessory nerves.

Choroid plexus of fourth ventricle, a small fold of pia mater, which enters the ventricle as this membrane is passing from the cerebellum to the spinal cord.

CEREBELLUM,

Consists of a central portion called superior and inferior vermiform processes, and of two hemispheres, united inferiorly by the pons Varolii.

Hemispheres are flat superiorly, where they correspond to the tentorium, and convex inferiorly where they lie in the inferior occipital fossa: they are separated behind by a deep notch, and inferiorly the two hemispheres are separated by a deep fossa, *vallecula*. The surface of each presents semicircular, parallel, narrow lines, *laminæ*, arising from the disposition of the grey matter of the

organ ; between these laminae the pia mater enters, but the arachnoid passes over them.

Great horizontal fissure divides the cerebellum into an upper and lower mass, running round its free border.

The upper surface of each hemisphere presents the *quadrate* and *posterior superior lobes* : on the under surface are seen the *posterior inferior*, *slender biventral lobes*, the *amygdala*, and the *flocculus*.

Superior vermiform process, a small conical eminence corresponding to the superior and central part of the cerebellum.

Inferior vermiform process, larger than the superior, and corresponding to the inferior and central part of the cerebellum. It presents the *pyramid*, *uvula*, and *nodule*.

Arbor vitæ, the branching of the medullary substance of the cerebellum, exposed by making a vertical section of it.

Corpus dentatum, a small oval mass of grey substance, surrounded by a yellow zigzag line, and exposed upon making a section of the cerebellum parallel to, but an inch distant from, the median line.

PONS VAROLII,

Is a broad transverse white commissure, connecting the two lobes of the cerebellum. In the median line is a longitudinal groove for the basilar

artery. Its appearance is striated, marking the course of its superficial fibres.

MEDULLA OBLONGATA.

A large pyramidal process of nerve structure, extending from the lower margin of the pons Varolii to the commencement of the spinal cord. About an inch and a quarter in length it presents an *anterior* and *posterior median fissure*, which divides the medulla into two lateral portions. Each half is composed of the following columns, which are separated from each other by distinct grooves.

Anterior pyramids.—Two anterior white bundles, which pass up beneath the pons: on separating them, fibres are seen which pass from one to the other, *decussation of the pyramids*.

Olivary bodies.—Two oval bodies placed external to the former; contain in their interior nuclei of grey matter, *corpus dentatum*.

Restiform bodies, large, situated posteriorly.

Posterior pyramids, small and cordlike, lie on each side of the posterior median fissure.

BASE OF THE BRAIN,

Presents on each side of the median line the anterior and middle lobes of the cerebrum, separated from each other by the fissure of Sylvius, and a lobe of the cerebellum resting upon the posterior

lobe of the cerebrum. In the median line, proceeding from before backwards, is the anterior extremity of the median fissure (on either side of which run the the olfactory nerves), the lower extremity of the corpus callosum, the optic commissure, the tuber cinereum, the corpora albicantia, the pituitary body and infundibulum, the locus perforatus (on either side of this is the crus cerebri), the pons Varolii, and lastly, the posterior extremity of the median fissure.

ORIGIN OF THE CEREBRAL NERVES.

First nerve (olfactory) arises by three roots, the external, long and white, from the fissure of Sylvius, and the island of Reil; the internal, also white, from the posterior internal surface of the under part of the anterior lobe; and the middle, short and grey, from a grey tubercle upon the under surface of the anterior lobe. *C.S.*

Second (optic) arises by two roots from the corpora quadrigemina, the corpora geniculata, and the optic thalamus; the roots unite and form the tractus opticus, which passes round and becomes slightly attached to the crus cerebri; the tracts, one from either side, then unite in the optic commissure, having previously received a few fibres from the tuber cinereum; from the anterior and outer part of this commissure proceed the optic nerves properly so-called.

Third (motor oculi) arises from the inner side of the crus cerebri, near the pons Varolii; its fibres may be traced to a grey nucleus at the floor of the aqueduct of Sylvius. *How 7. 29. 8 high +*

Fourth (trochlearis) arises from the valve of Vieussens, by several delicate filaments, which meet those of the opposite side in the mesial line.

Fifth nerve (trigeminal) consists of two portions, a sensory and a motor. *The motor root*, the smaller, arises from the pyramidal body, in the substance of the pons Varolii, and the outer angle of the floor of the fourth ventricle; and the *sensory root*, from the fasciculus teres and restiform tract. Upon the sensory root is developed a large ganglion, *Gasserian*, the motor passing beneath it. *How 7. 29. 8 high +*

Sixth (abducens) arises from the medulla passing through the fibres of pyramidal body to a nucleus beneath the fasciculus teres in the floor of the fourth ventricle, and emerging from the transverse groove of the medulla.

Seventh nerve consists of the *portio dura*, or facial, and the *portio mollis*, or auditory. *The portio dura* arises from the lateral tract between the olivary and restiform bodies, and to the grey nucleus before mentioned. *The portio mollis* arises by white striæ from the median fissure in the fourth ventricle, and is connected with the calamus scriptorius and the flocculus. *How 7. 29. 8 high +*

Eighth nerve consists of the *glosso-pharyngeal*, *How 7. 29. 8 high +*

pneumogastric, and *spinal-accessory*. The *glossopharyngeal* arises by four or five filaments from a grey nucleus at the floor of the fourth ventricle, between the vagal and auditory nuclei, and emerges from the groove between the olivary and restiform bodies. The *pneumogastric* arises by eight or ten filaments from the groove below the *glossopharyngeal*; its deep origin is from the floor of the fourth ventricle. The *spinal-accessory* arises by several filaments from the lateral tract of the medulla and spinal cord, and the floor of the fourth ventricle, close to the *calamus scriptorius*.

The *ninth* (*hypo-glossal*), arises by ten or fifteen filaments from the groove between the pyramidal and olivary bodies, about half an inch below the origin of the *sixth*, the fibres being traced to the floor of the fourth ventricle, near the middle line.

DISTRIBUTION OF CEREBRAL NERVES.

First pair (or *olfactory*) sends off three sets of branches to the upper part of the nose. *Internal branches* to *septum nasi*; *middle branches* to mucous membrane of roof of each nostril; and *external branches* to upper and middle spongy bones.

Second pair (or *optic*) pierce the sclerotic coat of the eye, and form the retina.

Third pair (or *motores oculorum*). *Superior*,

or *smaller branch*, supplies the superior rectus, and the levator palpebræ. *Inferior, or larger branch*, supplies the internal rectus, the inferior rectus, and the inferior oblique; and also sends a branch to the lenticular ganglion.

Fourth pair (or trochleares) are distributed to superior oblique muscles of the eyes.

Fifth pair (or trigeminal) first from the Gasserian ganglion, and divide into three main branches—viz., ophthalmic, superior and inferior maxillary.

Ophthalmic division—Divides into—1. *Lachrymal nerve*, which, passing along the outer wall of the orbit, sends a branch downwards to the orbital branch of the superior maxillary nerve; then gives filaments to the lachrymal gland and the conjunctiva; and finally, perforating the fibrous attachment of the upper eyelid, terminates in the integument of the forehead. 2. *Frontal nerve*, enters the orbit above the levator palpebræ; it divides into supra-orbital and supra-trochlear: supra-orbital nerve, escaping through the supra-orbital notch, is distributed to the integuments of the forehead; the supra-trochlear passing above the pulley of the trochlearis muscle, sends a filament to the infra-trochlear branch of the nasal nerve, and terminates in the mucous membrane of the inner canthus and in the integuments of the forehead. 3. *Nasal nerve*, enters the orbit between the two heads of the rectus externus muscle. It

gives a filament to the lenticular ganglion, two or three ciliary nerves, and the infra-trochlear branch; the nerve then enters the skull by the foramen ethmoideum anterius, and escaping into the nose by a fissure in the cribriform plate of the ethmoid bone, terminates at the tip of the nose: the terminal filament is called naso-lobular.

Superior maxillary division.—1. *Orbital branch*, which sends off a malar twig and a temporal twig. 2. *Two branches to Meckel's ganglion.* 3. *Posterior dental*, which sends off an anterior branch to the buccinator muscle and gums, and a posterior branch to the molar teeth. 4. *Anterior dental*, to the antrum and front teeth. 5. *Infra-orbital*, distributed to the eyelid, nose, and lips.

Inferior maxillary division.—1. The *superior or external branch*, which is joined by the motor portion of the fifth nerve, sends off deep temporal twigs—a masseteric branch to masseter muscle and temporo-maxillary articulation, a buccal branch to the buccinator, and temporal muscles, and a pterygoid branch to the pterygoid muscles. 2. *Inferior or internal branch*, sends off the inferior dental (which gives off the mylo-hyoid nerve), it supplies the teeth, and terminates in the mental nerve; the gustatory, which goes to the glands, mucous membrane, and papillæ of the tongue, and is joined by the corda tympani nerve; and the auriculo-temporal, which supplies the external ear, and the

integuments of the side of the head, and the temporo-maxillary articulation.

The greater part of the buccal nerve goes to the mucous membrane. The buccinator muscle is supplied by the facial as its motor nerve.

GANGLIA IN CONNEXION WITH THE FIFTH PAIR.

Gasserian ganglion.—A large grey semilunar body, analogous to the ganglia upon the posterior roots of the spinal nerves. It lies in a depression at the apex of the petrous portion of the temporal bone, and presents anteriorly a convex border, from which proceed the three main divisions of the fifth, just described. The motor root of the fifth nerve joins the inferior maxillary division only.

The lenticular ganglion is situated between the optic nerve and external rectus muscle; it receives at its posterior superior angle a long filament from the nasal branch of the fifth and sympathetic branches from the cavernous plexus, and at its posterior inferior angle a branch from the inferior division of the third. Its anterior angles furnish the ciliary nerves, about twenty in number, which run along the optic nerve, pierce the back part of the sclerotica, run forward between it and the choroid coat, enter the ciliary ligament, and are ultimately distributed to the iris.

Meckel's ganglion.—A little red body of triangular shape, situated deep in the fat and cellular tissue of the spheno-maxillary fossa : it communicates superiorly by two small twigs with the second division of the fifth, and sends off—1. Spheno-palatine nerve to the mucous membrane of the superior and middle spongy bones : it gives off the naso-palatine branch which runs along the septum nasi, and terminates in the foramen incisivum. 2. Palatine nerve, which descends in the palatine canal, and divides into anterior branches which supply the teeth, and posterior and middle branches which supply the tonsils, soft palate, and uvula. 3. Vidian nerve, which passes backward through the Vidian canal, enters the cranium by the foramen lacerum medium, and divides into an inferior and a superior branch, having first sent filaments to the sphenoidal sinus : the inferior branch enters the carotid canal, and unites with the branches of the sympathetic, whilst the superior branch runs beneath the Gasserian ganglion on the petrous portion of the temporal bone, enters the hiatus Fallopii, and attaches itself to the portio dura nerve. 4. Pharyngeal, passes through the pterygo-palatine canal to supply pharynx.

Otic ganglion, a small body connected with the inferior maxillary nerve near the foramen ovale ; it receives its motor root from the branch to the internal pterygoid muscle ; its sensory from the tem-

poro-auricular, and its sympathetic from the nervi molles around the middle meningeal artery. It communicates with the lesser petrosal nerve of the glosso-pharyngeal.

The naso-palatine ganglion lies in the anterior palatine foramen, and is formed by the anterior palatine branches from Meckel's ganglion.

The submaxillary ganglion lies on the hyoglossus muscle, receives its sensory fibres from the gustatory; its motor from the chordæ tympani, and its sympathetic from the nervi molles around the facial artery.

Sixth pair, or abducentes, are distributed to the external rectus muscle on each side exclusively, and also receive two filaments from the sympathetic in the cavernous sinus.

Seventh pair, consists of two portions—viz., portio dura and portio mollis; both enter the meatus auditorius internus.

Portio dura, or facial nerve, passes through the aqueductus Fallopii, and emerges at the stylo-mastoid foramen. It gives off—1, a branch to the stapedius muscle; 2, the chorda tympani, which enters the tympanum a little below the pyramid; it then passes between the handle of the malleus and the long process of the incus, emerges from the tympanum through the canal of Huguier; external to the fissuri Glaseri unites with the gustatory nerve, and then passes on to supply

the tongue ; 3, posterior auricular ; 4, digastric ; 5, stylo-hyoid nerves : and then divides into—1, cervico-facial division, which gives off, buccal, supra-maxillary and infra-maxillary branches ; and, 2, temporo-facial division, which sends off temporal, malar, and infra-orbital branches. The interlacement of the branches of the facial nerve, as it passes through the parotid gland, is called “*pes anserinus*.”

Portio mollis, or *auditory nerve*.—1. Branch to cochlea. 2. Branch to vestibule and semicircular canals.

Portio intermedia, a small filament between the portio dura and mollis ; and connects the two latter in the internal auditory meatus.

Eighth nerve, consists of three portions—viz., glosso-pharyngeal, pneumogastric, and spinal accessory. They escape from the skull by the jugular foramen.

Glosso-pharyngeal, or first branch of the eighth has two ganglia, *petrous* and *jugular* ; it gives off—1, Jacobson’s nerve, which enters the tympanum by a small foramen upon the under surface of the temporal bone, and sends a filament (small petrosal to the otic ganglion, and carotid filaments which ramify on the coats of the vessel, and communicate with the sympathetic and vagus nerves. 2. Branches to the pharyngeal plexus. 3. Branches to the tonsillitic plexus. 4. Branches to the stylo-

pharyngeus, and superior and middle constrictors of the pharynx, mucous membrane of fauces, &c. 5. Branches to the papillæ and mucous membrane at the root of the tongue.

Pneumogastric, or second branch of the eighth, gives off—1. Auricular branches (*Arnold's*) which supply the cranial aspect of the pinna.—2. Branches to assist in forming the pharyngeal plexus. 3. Superior laryngeal nerve, which gives off an external laryngeal branch to the exterior of the larynx, the inferior constrictor of the pharynx, and crico-thyroid muscle, and then pierces the thyro-hyoid membrane in company with the superior laryngeal artery, and supplies the epiglottis, mucous membrane, and arytenoid muscle. 4. Cardiac branches, to the cardiac nerves of the sympathetic. 5. Inferior laryngeal, or recurrent nerve, which sends off cardiac filaments, branches to the fore part of the trachea and thyroid gland, and branches to the pharynx, laryngeal muscles, and mucous membrane, on which they communicate with branches of the superior laryngeal. 6. Pulmonary branches, which send off branches in front of the bronchial tubes to form the anterior or lesser pulmonic plexus; this plexus sends filaments to the pulmonary vessels, also to the lungs and pericardium, and to the posterior pulmonic plexus. 7. Posterior or greater pulmonic plexus, is formed by the pneumogastric nerves, which increase in size

at the root of each lung, and subdivide and unite in an areolar manner. This plexus is joined by several branches of the sympathetic nerve, and its branches accompany the bronchial tubes through the substance of the lung. 8. Œsophageal plexus, or plexus gulæ; is formed by the communications of both nerves, encircling the Œsophagus in their course along this tube. 9. Gastric plexus is formed by both nerves dividing, subdividing, and uniting upon the stomach. The left pneumo-gastric nerve is anterior upon the stomach, and sends branches to the lesser omentum and liver; the right is posterior, and sends branches to the splenic plexus.

~~Nervus accessorius~~, or third branch of the eighth.

1. Branches to communicate with the eighth, ninth and sympathetic nerves. 2. Branches to the sterno-cleido-mastoid muscle, which muscle it then perforates. 3. Terminal branches to the trapezius muscle.

Ninth pair, or ~~lingual~~ ^{mylohyoid}—1. Descendens noni receives a filament from the pneumogastric, unites with the internal descending branches of the cervical plexus, forming a small plexus, in loops, the branches of which pass to the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles. 2. A branch to the thyro-hyoid muscle. 3. Branches to the hyo-glossus, stylo-glossus, genio-hyoid, genio-hyo-glossus, hyo-glossus, and lingualis muscles, and to the gustatory branch of the fifth pair. 4. Termi-

nal branches to the genio-hyo-glossus muscle, and muscular structure of the tongue.

SPINAL NERVES.

Symmetrical, thirty-one pairs—viz., eight cervical, twelve dorsal, five lumbar, five sacral, and one coccygeal. Each spinal nerve has two roots, an anterior and a posterior. The anterior is small, and is the motor division. The posterior large, with a ganglion upon it, and is for sensation. These roots are separated by the cord itself, and by the ligamentum dentatum. The anterior root is connected to the posterior root in the inter-vertebral foramen, beyond the ganglion. On the outer side of the ganglion both nerves unite in a single cord, which, after a short course, divides into an exterior and posterior branch. The posterior branches of this division are the smaller (except that of the second cervical), and are distributed to the dorsal muscles and integuments. The anterior branches form the several plexuses which supply the muscles and integuments anterior to the spine, and also the extremities.

DISTRIBUTION OF THE EIGHT CERVICAL NERVES AND FIRST DORSAL NERVES.

Posterior branches, are small, except the second cervical, which perforates the complexus muscle,

and accompanies the occipital artery ; the rest are lost in the neighboring muscles and integuments.

Anterior branches.—The first, or sub-occipital, twists round the atlas, to unite with the second, forming the nervous loop of the atlas : and the second, having received the first, descends to unite with the third. The third unites in like manner with the fourth, and thus is formed, by the inferior branches of the four first cervical nerves, the

CERVICAL PLEXUS.

From this plexus proceed :—

Branches to the platysma, integuments, parotid gland, ear, and back of the head.

1. *Great auricular*, arises chiefly from the second and third cervical, and is distributed to the ear, the face, and the mastoid region ; it accompanies the external jugular vein.

2. *Small occipital*, which, arising from the second cervical, pierces the fascia behind the sterno-mastoid, and is distributed to the integuments of the scalp.

3. *Superficialis colli*, from second and third cervical, is distributed to the side and front of the neck.

4. *Descending branches*, from third and fourth cervical, which are divided into sternal, clavicular, and acromial, and supply the integuments.

5. *Branches*, generally two in number, which form loops with the descendens noni in front of the internal jugular vein.

6. *Phrenic*, or *internal respiratory*, which arises from the third and fourth cervical, and has a small filament also from the fifth cervical: it sends branches to the liver, pericardium, inferior cava, and terminates in the diaphragm.

7. *Branches*, which are given to the sterno-mastoid and trapezius (these muscles are also supplied by the spinal accessory); to the levator anguli scapulæ, the scaleni, and recti capitis antici.

8. *Connecting branches* with the pneumogastric, hypoglossal, and sympathetic nerves.

THE BRACHIAL PLEXUS

Is formed by the union of the anterior branches of the four inferior cervical and first dorsal nerves.

From this plexus proceed:—

1. *A branch* to join the phrenic nerve.

2. *Branches*, to the longus colli, scaleni, and sub-clavius muscles.

3. *The external respiratory nerve of Bell*, which, arising from the fifth and sixth cervical, passes behind the axillary vessels, and is distributed to the serratus magnus.

4. *Thoracic nerves*, three or four in number,

which forms loops around the axillary artery, and supply the pectoral muscles.

5. Nerve to the *rhomboid* muscles, arises from the fifth, and passes through the fibres of the *scalenus medius*.

6. *Supra-scapular nerve*, which passes through the notch in the scapula, and supplies the *supraspinatus* and *infra-spinatus* muscles.

The brachial plexus, when in relation with the axillary artery, resolves itself into three cords, outer, inner, and posterior. From the outer are derived the musculo-cutaneous, the outer head of the median, and the external anterior thoracic; from the inner come the internal anterior thoracic, the inner head of the median, internal cutaneous, lesser internal cutaneous and ulnar nerves: from the posterior cord are derived the circumflex, musculo-spiral and three subscapular nerves.

7. *Subscapular nerves*, are three or four in number; they descend behind the vessels to the subscapular, *latissimus dorsi*, and *teres major* muscles.

8. *Internal cutaneous nerve*, sends one branch which descends over the bend of the elbow as low as the wrist, and another branch which descends towards inner condyle, and sends branches to inner and posterior part of the forearm.

9. *External cutaneous*, musculo-cutaneous, or perforans *Cassieri*, which sends branches to the *coraco-brachialis*, *biceps*, and *brachialis anticus*; an

anterior branch to the ball of the thumb and palm of the hand ; and a posterior branch to the dorsum of the hand.

10. *Median nerve*, sends branches to the superficial and deep pronators and flexors of the forearm, except the flexor carpi ulnaris, and half the flexor digitorum profundus, which are supplied by the ulnar nerve ; the anterior interosseous nerve, which sends a branch to the pronator quadratus, half the flexor profundus and flexor longus pollicis, and another to the dorsum of the hand ; a superficial branch which is given off above the wrist, and which runs to the palm of the hand ; and five digital branches, which supply the thumb, index, and middle fingers, and the radial side of the ring fingers : the muscles of the ball of the thumb, and two radial lumbricales.

11. *Ulnar nerve*, sends branches to the skin of forearm, flexor profundus, and flexor carpi ulnaris muscles ; the nervus dorsalis carpi ulnaris to the integuments on the dorsum of the hand and the two and a half inner fingers ; the superficial palmar branch, which divides into three digital branches for the supply of the little finger and the ulnar edge of the ring finger ; and the deep palmar branch to join the deep palmar arch, which supplies the inter-ossei muscles, two inner lumbricales, the adductor pollicis muscle, and the deep head of the flexor brevis pollicis.

11. *Musculo - spiral*, or radial nerve, sends branches to the triceps, through which it winds ; a long cutaneous branch to the elbow ; branches to anconeus, the supinator longus and extensors ; the anterior or radial branch, which runs along the inner side of the supinator radii longus, and sends a branch to the integuments of the thumb, and another to the dorsum of the hand, which supplies the index and middle fingers, and communicates with the dorsalis ulnaris ; and a deep branch, or posterior interosseous, which supplies by superficial and deep branches the extensor muscles, and terminates in a ganglion on the wrist beneath the extensor indicis.

12. *Circumflex nerve*, sends branches to the deltoid and teres minor muscles, skin, and shoulder-joint.

TWELVE PAIR OF DORSAL NERVES.

Posterior branches are small, and pass backwards to the muscles and integuments of the back and loins.

Anterior branches, or *intercostals*. First is the largest ; it contributes partly to form the brachial plexus. Second and third run backwards and outwards, and at the angle of the ribs pass between the intercostal muscles, and running along the lower edge of each rib supply the surrounding muscles : opposite the axilla they send off the intercosto-humeral nerves, of which one, joining a

branch from the brachial plexus, forms the nerve of Wrisberg, for the skin of the arm, and the terminal branches supply the muscles and skin upon the lateral and fore part of the thorax. Fourth to twelfth, inclusive, are similar to the second and third in distribution, supplying the intercostal and adjacent muscles: the two last go chiefly to the diaphragm, and the twelfth sends a branch to join the first lumbar. [All the intercostals are connected by two short branches to the ganglia of the sympathetic.]

FIVE PAIR OF LUMBAR NERVES.

They are larger than the dorsal, and like them divide into posterior and anterior branches.

Posterior branches are distributed to the lumbar muscles and integuments.

Anterior branches unite in the substance of the psoas muscle, to form the lumbar plexus.

LUMBAR PLEXUS.

1. *Ilio-inguinal*, from the first nerve, sends branches to the abdominal muscles, a cutaneous branch to the integuments on the outer part of the thigh, and the ilio-scrotal.

2. *Ilio-hypogastric*, from the first nerve to the abdominal muscles and skin over the gluteal region, and to the skin of the abdomen above the pubes.

3. *Genito-crural*, from the second nerve, supplies through its genital branch the spermatic cord, and cremaster : through its crural branches it distributes filaments to the upper part of the thigh, communicating with the middle cutaneous.

4. *External cutaneous*, from the second nerve, sends branches to outer and back part of thigh.

5. *Anterior crural nerve*, formed by the second, third, and fourth nerves, passes beneath Poupart's ligament, and divides into two fasciculi. The superior fasciculus sends four or five long branches, which pierce the fascia lata, and descend to the knee: some of them accompany the saphena vein; the deep fasciculus sends external muscular branches to the vastus externus, rectus, iliacus internus muscles, and internal branches to the sartorius, vastus internus, and crureus : branches also accompany the femoral artery, near to the knee, the *internal saphenous nerve*, which joins the saphena vein at the knee, lying between the tendons of the gracilis and sartorius, goes on to the inner side of the foot, sending off numerous branches to the integuments.

6. *Obturator nerve*, from the third and fourth nerves, sends branches to the obturator externus, an anterior branch to the adductor longus, pectineus, and gracilis, and a posterior branch to the adductor magnus and brevis muscles : articular nerves are given to the hip and knee joints.

7. *Accessory-obturator nerve*, inconstant, divides into branches which supply the hip-joint, and the pectineus.

8. *Lumbo-sacral nerve* proceeds from the fourth and fifth lumbar into the pelvis, and divides into the superior gluteal and the communicating nerve: the superior gluteal is distributed to the gluteus medius, minimus, and tensor fasciæ femoris muscles: and the communicating branch joins the first sacral nerve.

FIVE PAIR OF SACRAL NERVES.

Posterior branches, very small, to muscles and integuments.

Anterior branches, very large, particularly the three superior; these five, with the communicating branch of the lumbo-sacral, form the sacral plexus.

SACRAL PLEXUS

Sends off internal or pelvic branches, which are named Hæmorrhoidal, Vesical, Uterine, and Vaginal. External branches.

1. *Muscular nerves*, to the pyriformis, obturator internus, gemelli, quadratus femoris and levator ani.

2. *Lesser sciatic nerve*, to the gluteus maximus and integuments of the buttock and thigh.

3. *Posterior cutaneous nerve*, to the back part of the thigh and leg.

4. *Pudic nerve*, which sends an inferior branch to the muscles of the perineum and to the scrotum ; and a superior branch which passes along the dorsum of the penis to its glans.

5. *Great sciatic nerve*, sends off several branches to supply the semi-membranosus, semi-tendinosus, biceps, and adductor magnus muscles, also the hip joint ; it divides at the upper and outer part of the popliteal space into two branches—viz., the peroneal and the popliteal nerves. *The peroneal nerve* first sends off the communicans peronei of the leg, which communicates with the external saphenous nerve ; it next gives off the musculo-cutaneous nerve, which divides into an internal and an external branch, the former being distributed to the integuments of the inner side of great, and contiguous sides of second and third toes, the latter to the outer side of third, the whole of the fourth and the inner side of the fifth toes ; and lastly, the anterior tibial, which winds round the head of the fibula, and supplies the integuments on the anterior part of the leg, the tibialis anticus, the extensor digitorum longus, the extensor pollicis, and the extensor digitorum brevis muscles, and terminates at the first interosseal space by communicating with the plantar nerves, having first supplied the inner interosseous muscle. *The popliteal division* of the great sciatic first sends off the external saphenous nerve, and branches to the gastrocne-

mius, soleus, plantaris, and popliteus muscles. At the lower border of the popliteus muscle it becomes the posterior tibial, which supplies the tibialis posticus, flexor longus digitorum, and flexor longus pollicis ; it finally divides into the internal and external plantar nerves ; the former sending branches to the three and a half inner toes, to the abductor pollicis, flexor brevis pollicis, and two inner lumbricales ; the latter a superficial branch to the little toe and outer side of the fourth toe, and a deep branch to all the muscles of foot except those previously described.

SYMPATHETIC OR GANGLIONIC SYSTEM OF NERVES.

The sympathetic nerves, characterized by their grey colour and by their numerous ganglia, form a system, which communicates with all the cerebral nerves, except the three nerves of special sense [viz., the olfactory, the optic, and the auditory] and with all the spinal nerves. In the chest and abdomen large plexuses are formed in front of the vertebral column.

THE CERVICAL GANGLIA

Are three in number.

Superior cervical ganglion extends from the first

to the third cervical vertebra, and sends off—1. Two superior branches, which ascend along with the carotid artery in the carotid canal to the cavernous sinus, where they communicate with the sixth or abducens nerve, and with the Vidian nerve. 2. Descending or inferior filaments, which join the laryngeal and pneumogastric nerves, the superior cardiac nerve, and the middle cervical ganglion, if it exists; if not, they join the inferior ganglion. 3. Internal branches, which unite with the pharyngeal plexus. 4. External branches, to join the superior cervical nerves. 5. Anterior branches, which unite with the pneumogastric and facial nerves, and form a plexus around the carotid artery, from which branches proceed along the external carotid and its divisions.

Middle cervical ganglion, placed opposite the fifth or sixth cervical vertebræ, is sometimes absent; when present it sends branches to unite with the vagus and cervical nerves, branches to join the cardiac nerves, and filaments to the inferior thyroid artery.

Inferior cervical ganglion is situated between the transverse process of the last cervical vertebra and the neck of the first rib; it sends branches to the phrenic nerve, brachial plexus, subclavian artery and its ramifications, and branches to the inferior cardiac nerve.

Cardiac nerves are three in number, and are

named superior, middle, and inferior. 1. Superior Cardiac Nerves arise by two or three filaments from the superior cervical ganglia, communicate with the vagus and laryngeal nerves, and with the middle and inferior cervical ganglion, pass along the coats of the arteria innominata on the right side, and between the left carotid and left subclavian on the left side to the aorta, and here communicate with the recurrent nerves, and with the middle and inferior cardiac nerves, and the cardiac ganglion or plexus. 2. Middle Cardiac Nerves. That of the right side is generally the largest; on the left side it is sometimes wanting. They enter the thorax anterior to the subclavian artery, are joined by branches from the pneumogastric and recurrent nerves, and, passing along the arteria innominata, terminate in the cardiac ganglion and plexus. 3. Inferior Cardiac Branches. The right descends along the arteria innominata to the fore part of the arch of the aorta, and terminates in the anterior cardiac plexus: some branches pass between the aorta and pulmonary artery to the cardiac ganglion; on the left these nerves accompany the subclavian artery, and partly join the middle cardiac nerve and partly the cardiac plexus.

Cardiac plexus, or Cardiac Ganglion, is situated behind the ascending aorta, near its origin, in front of the trachea and right pulmonary artery; it consists of a plexus of nerves formed by the cardiac

nerves of the opposite sides and branches of the eighth pair and recurrent. In the meshes of this plexus several small ganglia are enclosed. Branches proceed from this plexus to the coronary and pulmonary vessels, to the aorta and vena cava, and to the substance of the heart itself.

Thoracic Ganglia are twelve on each side, sometimes only eleven, the last cervical and first dorsal being united. 1. Branches to the mediastinum, which ramify on the aorta and adjacent vessels, and communicate with the pulmonary plexus. 2. Great Splanchnic Nerve, is formed by distinct roots, from the 6th, 7th, 8th, and 9th ganglia; uniting on the 9th dorsal vertebra into one cord, it enters the abdomen through the crus of the diaphragm, and expands into the semilunar ganglion. 3. Lesser Splanchnic Nerve, arises by two roots from the 10th and 11th ganglia; uniting on the side of the last dorsal vertebra, it enters the abdomen through the crus of the diaphragm, and ends partly in the renal plexus and partly in the coeliac plexuses. 4. Smallest Splanchnic Nerve, arises from the 12th ganglion and ends in the renal and coeliac plexuses. Branches from the first and second ganglion go to the cardiac plexus; branches from the third and fourth to the pulmonary plexus.

Semilunar Ganglia are situated on the diaphragm, partly on the aorta, and on each side of the coeliac axis, and above and behind the supra-

renal capsules. They are the largest ganglia of the sympathetic; several nervous filaments, on which small ganglia are placed, pass from one to the other surrounding the coeliac axis, forming a plexus, called the

Solar Plexus, which is situated behind the stomach, above the pancreas, and in front of the aorta. It gives off—1. Branches in various directions, accompanying the blood-vessels, forming plexuses around each, and named accordingly, hepatic, splenic, and gastric, and these communicate with the eighth pair. 2. Branches descending in front of the aorta, which subdivide at the renal and mesenteric arteries, accompanying them, and forming plexuses, named accordingly, renal, superior and inferior mesenteric, and into each of these branches of the lumbar ganglia enter.

Renal Plexus receives the lesser splanchnic nerves; from it descends the spermatic plexus, which goes to the testicle in the male, and to the ovary and uterus in the female.

Inferior Mesenteric Plexus sends branches which descend to the brim of the pelvis, unite with others from the lumbar ganglia, and form a plexus around the internal iliac artery and its branches, named hypogastric plexus. It is joined by numerous filaments from the lumbar and sacral ganglia of the sympathetic, and communicates with the pelvic branches of the sacral plexus.

Lumbar Ganglia are five on each side, sometimes only three or four. 1. Filaments to anterior branches of lumbar spinal nerves. 2. Filaments to assist in forming the several abdominal plexuses.

Sacral Ganglia are three or four in number. 1. Filaments to sacral nerves. 2. Filaments to hypogastric and pelvic plexuses. 3. A small branch from the last ganglion, which passes in front of the coccyx, there forming with its fellow the

Ganglion Impar, which sends branches to the coccygeus, levator, and sphincter ani muscles.

THE THORAX AND ITS CONTENTS.

The thorax is bounded anteriorly by the sternum and cartilages of the ribs, posteriorly by the vertebræ and the ribs, and on each side by the shafts of the ribs and the intercostal muscles. Its upper opening is transversely oval, and allows the exit and entrance of vessels, nerves, and muscles, to and from its cavity; its inferior opening, or circumference, is much larger, and closed by the diaphragm.

The thorax contains the heart and lungs, and also several vessels, nerves, glands, &c.

THE PLEURÆ

Are two serous membranes, one on each side, and distinct from each other, which cover the inner surface of the thorax, and are reflected upon the outer surfaces of the parts contained in its cavity. That portion of the pleura which lines the thorax is called the *parietal layer*, and that which lines the contained parts the *visceral layer*. Each pleura can be traced in the following manner:—From the posterior surface of the sternum it passes backwards until it meets with the anterior surface of the pericardium, along the side of which it passes to the anterior surface of the root of the lung; from this it passes upon the lung, and is reflected over the entire surface of the organ, until it arrives at the posterior surface of its root and of the pericardium, from whence it passes upon the sides of the bodies of the vertebræ, reaching as high as the transverse process of the sixth cervical vertebra on the right side, the seventh on the left, and descending to the diaphragm, the thoracic aspect of which it covers; it finally lines the ribs and intercostal muscles, until it arrives at the portion which was opened, and which corresponds to the posterior aspect of the sternum.

Ligamentum latum pulmonis (one on each side) is merely a double triangular layer of pleura, formed by the reflection of the membrane from the lower

edge of the root of the lung upon the vessels from the heart.

ANTERIOR MEDIASTINUM,

A triangular interspace between the right and left pleura behind the sternum ; the base is formed by the sternum, the sides by the separated pleuræ, and the apex corresponds to the anterior surface of the pericardium, where the pleuræ separate to enclose this bag. Thus formed, it contains the origins of the sterno-hyoid and sterno-thyroid muscles, the remains of the thymus gland with its vessels, lymphatic glands and absorbents, the triangularis sterni muscles, loose cellular tissue, and the internal mammary artery of the left side.

MIDDLE MEDIASTINUM

Is of oval shape, and is formed by the reflection of the pleuræ upon the sides of the pericardium ; it consequently contains this bag and its contents—viz., the heart, with its vessels ; also the phrenic nerves and the bifurcation of the trachea.

POSTERIOR MEDIASTINUM

Is formed by the reflection of the pleuræ upon the sides of the bodies of the vertebræ ; it is of triangular form, the apex, anterior, corresponding to the posterior surface of the pericardium, the sides formed by the pleuræ, and the base represented by

the anterior surfaces of the bodies of the vertebræ ; it extends from the third to the tenth dorsal vertebra, and contains the following structures :—the œsophagus and pneumogastric nerves, the thoracic duct, the vena azygos, the thoracic aorta, lymphatic glands, absorbents, bronchial and œsophageal arteries, the right aortic intercostal arteries, and loose cellular tissue.

THE LUNGS.

Are two soft, spongy, vascular organs, one contained in each side of the cavity of the chest. Each lung resembles a cone, with that side corresponding to the median line truncated ; the base, concave, corresponds to the diaphragm ; the obtuse rounded apex rises in the neck, a little above the level of the first rib ; the external convex surface corresponds to the internal concave surface of the thoracic parietes, and the flat or truncated surface corresponds to the mediastina. The posterior edge of the lung is thick and rounded, whilst the anterior is thin and irregular. Each lung is divided into two lobes, which are separated from each other by fissures ; a little above the centre of each is the *root* formed by the pulmonary vessels and bronchus, connected to each other by cellular tissue, and invested by the pleura. The bronchus is situated posterior and superior to the pulmonary vessels ; the two pulmonary veins are placed ante-

rior and inferior to the artery and bronchus, and the pulmonary artery is placed between the bronchus and the pulmonary veins, but behind the pulmonary veins and before the bronchus. On the left side, the bronchus, more oblique than its fellow, descends near the root of the lung so as to lie between the artery and vein. The *root* of each lung has anterior to it the phrenic nerve and filaments of the pneumogastric nerve, posterior to it the pulmonic plexus. The root of the right lung has the vena azygos arching over it.

The right and left lungs differ from each other in some unimportant particulars : the right lung is broader and shorter than the left, and consists of three lobes, separated by two fissures ; the right also ascends higher in the neck, and the anterior edge of the left presents a notch where it corresponds to the apex of the heart.

The structure of the lungs consists of numerous small lobules, which are the alveolar dilatations of the smallest bronchial tubes : the lobules are held together by blood-vessels and interlobular tissue ; they vary from half a line to a line in diameter, and do not communicate with one another, except through the medium of the air tubes. The bronchial tubes enter the lungs, and by frequent divisions rapidly diminish in size, until they may be traced to about half a line in diameter, beyond which the tubes are entirely membranous. A little

beyond this stage they are termed lobular passages, and then terminate in an irregularly pouched dilatation, the air cell or alveolus. The cells are lined with squamous epithelium, which may be traced through the lobular passages as far as the minute bronchi, which are lined with cylindrical ciliated epithelium. Between the air cells is spread the capillary network of the pulmonary vessels, which are seen to come from an arterial circle close to the alveolus. The branches of the pulmonary artery accompany the divisions of the bronchi to their remote ramifications, and ultimately open into the pulmonary veins. The bronchial arteries supply nourishment to the bronchi and the parenchymatous structure of the lung. The lymphatics enter the bronchial glands, and its nerves come from the anterior and posterior pulmonary plexus of the pneumogastric, joined by branches from the dorsal sympathetic system.

TRACHEA AND ITS RAMIFICATIONS.

The windpipe, or trachea, is a cylindrical tube, about four and a half inches in length, extending from the cricoid cartilage of the larynx to the level of the third dorsal vertebra. It consists of from seventeen to twenty incomplete fibro-cartilaginous rings, truncated behind, and connected to each other by an elastic membrane ; about the posterior

fourth of each ring is deficient, and its place is supplied by fibrous membrane and unstriped or involuntary muscular fibre.

Opposite the third dorsal vertebra the trachea divides into the right and left bronchi; the right bronchus, larger than the left, runs transversely into the root of the lung, and divides into three branches; the left bronchus passes obliquely beneath the arch of the aorta to the root of the left lung, and divides into two branches.

The bronchi consist of cartilaginous rings, but as these tubes advance into the substance of the lung they diminish in size and firmness, until their place is supplied by fibrous tissue, involuntary muscular fibres, which tissue also disappears, and at length nothing remains but the mucous membrane, which terminates in the air-cells, upon which ramify the ultimate branches of the pulmonary artery and the commencing radicles of the pulmonary veins.

The mucous membrane is pale, closely connected with the deeper structures, and covered with columnar ciliated epithelium.

HEART AND PERICARDIUM.

The pericardium consists of two layers, an outer, or proper fibrous layer, and an inner, or serous layer. It is of conical form, the base below connected to the central division of the cordiform tendon of the diaphragm, the apex above corre-

sponding to the great vessels at the base of the heart, along the outer coats of which the fibrous layer is gradually lost; it is connected laterally to the pleura and to the pulmonary vessels; the phrenic nerves, one on each side, run in close contact with it to the diaphragm. Upon laying open the cavity of the pericardium, the serous layer is exposed, and, like all serous membranes, it consists of two portions—a parietal layer, which lines the inner surface of the fibrous pericardium, and a visceral layer, which lines the outer surface of the heart and great vessels. When the pericardium is fully opened, we bring into view, covered by the serous membrane, the right auricle, the vena cava superior, the left auricular appendix, the right ventricle, the tip of the left ventricle (which forms the apex of the heart), the aorta, the pulmonary artery, and the anterior branches of the coronary vessels, with the ramifications of the cardiac nerves. Upon turning up the heart its posterior surface will be brought into view, presenting the left auricle (proceeding to which, on either side, are the pulmonary veins) and the left ventricle.

The serous membrane may be traced in the following manner:—After having lined the fibrous pericardium it is reflected on the superior cava and the aorta, and the pulmonary artery, as these vessels are passing through the fibrous membrane, ascending highest, however, upon the aorta; in-

feriorly it is partly reflected around the inferior cava, as this vessel pierces the fibrous pericardium to enter the right auricle, and laterally it is reflected upon the pulmonary veins as these vessels pierce the fibrous pericardium to enter the left auricle; from these different points it reaches the surface of the heart, which it completely covers.

THE HEART is a hollow muscular organ of conical shape, situated obliquely between the lungs, its base being superior, posterior, and to the right side, its apex pointing towards the cartilage of the sixth rib of the left side. The axis of the heart is obliquely from right to left, and from behind forwards. It is retained in its situation by the great vessels and the reflections of the serous membrane.

The heart consists of four cavities, two auricles and two ventricles; the auricles are separated from each other by a partition, called septum auricularum, the ventricles by the septum ventriculorum. We shall examine these cavities in the order of the circulation.

THE RIGHT AURICLE is placed between the two venæ cavæ, the blood conveyed by which it receives and transmits to the right ventricle; the small loose portion is called the *auricular appendix*, and the portion between the cavæ the *sinus of the auricle*. Upon laying open this auricle, by a perpendicular cut from the superior cava to within a few lines of the entrance of the inferior cava, and by a second

cut from the centre of this at right angles towards the auricular appendix, the following parts present themselves :—

Tuberculum Loweri is seen mainly in the heart of the lower mammalia, between the orifices of the two cavæ.

Septum auricularum, a membrano-muscular partition separating this auricle from the left.

Fossa ovalis, an oval depression in the septum, which marks the situation of the foramen ovale, or the oval communication which existed between both auricles in the foetus. The edges of this fossa present a thickened margin, the *annulus ovalis*, the anterior part of which is named the left or anterior limbus of the fossa ovalis, and the posterior, the right or posterior limbus. This fossa and its limbi exist in the right aspect of the septum, on account of the valve in the foetus, which is destined to close the opening between the two auricles, when the pulmonic circulation is established, being situated in the left auricle, and being applied to the foramen on its left aspect. We accordingly find the left aspect of the septum auricularum nearly smooth.

Eustachian valve, a semilunar fold of the lining membrane, attached by one cornu to the anterior limbus of the fossa ovalis, and continued around the anterior aspect of the inferior vena cava, to reach the posterior limbus of the fossa ovalis, to which it is attached by its inferior cornu.

Musculi pectinati, the muscular bands situated in the auricular appendix.

Openings of the Venæ Cavæ.—The superior cava opens at the upper and front part of the auricle, its direction being downwards, forwards, and inwards; the inferior cava opens beneath, in a direction upwards, backwards, and inwards.

Opening of the Coronary Vein is situated between the Eustachian valve and the right ventricle, and is guarded by a semilunar valve (the coronary valve).

Opening of the Auricular Appendix is small and circular, and exists where this portion of the auricle joins the sinus.

Foramina Thebesii, small orifices on different parts of the auricle, the openings of small veins from the muscular structure of the heart.

Right Auriculo-ventricular opening, the large opening by which the auricle communicates with the ventricle, the boundaries of each cavity being marked by a white line.

RIGHT VENTRICLE, of conical form, is joined by its basis to the right auricle, its apex being above the apex of the heart, in consequence of the apex of this organ being formed by the left ventricle.

Septum ventriculorum, a thick muscular partition which separates one ventricle from the other, but belongs chiefly to the left.

Carneæ columnæ, the muscular projections in the

interior of the ventricle, which give it its irregular appearance; three larger than the rest are called *musculi papillares*, to which are attached the *chordæ tendineæ*.

Chordæ tendineæ, the delicate but strong tendinous chords which are connected by one extremity to the *carneæ columnæ*, and by the other to the tricuspid valve.

Conus arteriosus, the smooth surface of the ventricle towards the pulmonary opening.

Tricuspid Valve, three triangular duplicatures of the lining membrane of the heart, strengthened by the *chordæ tendineæ* which pass from their apices to their bases. These triangular valves are attached by their bases to the right auriculo-ventricular opening, and by their apices to the *chordæ tendineæ*, and prevent the regurgitation of the blood from the ventricle into the auricle, by closing the opening of communication between both cavities when the ventricle contracts.

Orifice of the Pulmonary Artery is situated at the left extremity of the base of the ventricle, close to the right auriculo-ventricular opening, which is situated inferior, posterior, and to its right, and separated from the mouth of the artery by the largest cusp of the tricuspid valve.

Pulmonary Semilunar Valves extend from the line of junction of the pulmonary artery and right ventricle into the cavity of the former. These

three valves are duplicatures of the lining membrane, and are attached by their convex edges to the roots of the pulmonary artery ; their free concave margins presenting in the centre a small tubercle, called *corpus Arantii*. These valves, when the blood passes from this ventricle into the pulmonary artery, are pressed down, and thus, by closing the opening, prevent a reflux of the blood back again into the ventricle.

LEFT AURICLE is placed at the upper and back part of the heart, and is of quadrilateral form. It is smaller than the right auricle, and receives, at its four angles, the openings of the pulmonary veins ; its parietes are much thicker than the right ; its auricular appendix smaller, but the *musculi pectinati* are the stronger : with the exception of the auricular appendix, its inner surface is smooth, and it communicates with its corresponding ventricle by the left auriculo-ventricular opening, which is situated inferior to the opening of the auricular appendix, and is marked by a whitish line. The *septum auricularum* presents towards this auricle a smooth aspect, from circumstances already explained.

LEFT VENTRICLE is longer, stronger, and smaller than the right ; from its greater length it forms the apex of the heart ; from its greater strength it is of power sufficient to propel the arterial blood through the aorta and its ramifications. We consequently find the *carneæ columnæ*, the *chordæ tendineæ*, the

bicuspid, or mitral valve, the parietes of the cavity, the aorta, which arises from it, and the semilunar valves, with their corpora Arantii, which guard the opening of this vessel, much stronger than in the right division of the heart.

The left auriculo-ventricular opening, and the mouth of the aorta, are situated at the base of this cavity, and are close to each other, the aortic opening being anterior, and both being separated, as in the right ventricle, by the larger division of the bicuspid valve. With the exception of the peculiarities just mentioned, the left auricle and ventricle are, in their anatomical configuration, similar to the right, and the several valves, muscular eminences, tendons, cords, &c., serve similar purposes: the septum ventriculorum belongs chiefly to the left ventricle.

ARTERIES.

THE AORTA

Is divided into three portions—viz., the arch of aorta, the thoracic aorta, and the abdominal aorta.

THE ARCH OF THE AORTA

Is divided into an ascending, transverse, and descending portion. It sends off five branches.

A. *Arteria coronaria dextra*, which sends a branch to the right auricle, a branch to the anterior

part of the right ventricle, and a branch to the posterior part of the right ventricle.

B. *Arteria coronaria sinistra*, which sends a branch to the left auricle, and a branch to the left ventricle.

C. *Arteria innominata*, $1\frac{1}{2}$ inch long, which divides behind the right sterno-clavicular joint into the right carotid and right subclavian arteries.

D. *Left carotid artery*.

E. *Left subclavian artery*.

THE COMMON CAROTIDS

Ascend the neck in the same sheath with the internal jugular vein and pneumogastric nerve, and divide opposite the upper border of the thyroid cartilage into two branches.

A. *External carotid artery*.

B. *Internal carotid artery*.

THE EXTERNAL CAROTID

Sends off ^{eight} ~~nine~~ branches, viz. :—

A. *Superior thyroid*, which sends off—1st, a hyoid branch; 2nd, a sterno-mastoid branch; 3rd, a superior laryngeal branch; 4th, a thyroid branch; and 5th, a crico-thyroid branch.

B. *Lingual*, which sends off—1st, a hyoid branch; 2nd, the dorsalis linguæ artery; 3rd, the sublingual artery; and 4th, the ranine artery.

C. *Facial*, which sends off—1st, the inferior

palatine; 2nd, the tonsillar; 3rd, the glandular; 4th, the submental; 5th the inferior labial; 6th, the inferior coronary; 7th, superior coronary; 8th, the lateral nasal; and 9th, the angular. 10. *maxillary*

D. *Occipital*, which gives off muscular branches, ~~superior sterno-mastoid~~, auricular, princeps cervicis, posterior meningeal, and the terminal branches, of which one enters the mastoid foramen; the others ramify in the scalp.

E. *Posterior auricular*, which gives off the muscular, the ~~glandular~~, and the stylo-mastoid.

F. *Ascending pharyngeal*, which gives off the pharyngeal branches and the meningeal branches.

G. *Transverse facial*, ~~sometimes~~ a branch of the temporal.

H. *Superficial temporal*, which gives off the anterior auricular, ~~the articular branches~~, the middle temporal, the posterior and anterior temporal.

I. *Internal maxillary*, which gives off, in the first part of its course, the tympanic which enters the fissura Glaseri, the arteria meningeal media, which enters the foramen spinosum, the inferior maxillary or dental which enters the dental foramen, and the arteria meningeal parva which enters the foramen ovale; from the second part of the artery which lies among the pterygoid muscles, are given off, the deep anterior and posterior temporal, the pterygoid, the masseteric, and the buccal; and from the third part of the artery which lies in the

spheno-maxillary fossa are derived the following, which all pass through bony foramina, the ~~superior~~ alveolar, the infra-orbital, the descending palatine, the Vidian, the pterygo-palatine, and the spheno-palatine or nasal.

THE INTERNAL CAROTID

Supplies no vessels in the neck, but in its passage through the petrous portion of the temporal bone, gives off—

A. *The tympanic.*

B. *The arteriæ receptaculi*, or vessels to the cavernous sinus.

C. *The anterior meningeal.*

Opposite the anterior clinoid process it divides into—

A. *Ophthalmic artery*, which sends off—1st, the lachrymal; 2nd, the centralis retinæ; 3rd, the supra-orbital; 4th, the ciliary branches; 5th, the muscular; 6th, the posterior ethmoidal; 7th, the anterior ethmoidal; 8th, the palpebral; 9th, the nasal; 10th, the frontal; and 11th, the anterior ciliary. *2nd & 3rd are long ciliary.*

B. *Posterior communicating artery.*

C. *Anterior cerebral*, which sends off—1st, the anterior communicans; 2nd, the arteria corporis callosi; and 3rd, the middle cerebral, which furnishes the arteria choroidea.

THE SUBCLAVIAN ARTERY.

Extends as far as the lower border of the first rib. It sends off ~~five~~ branches.

A. *Vertebral*, which ascends through the foramina in transverse processes of cervical vertebræ, and gives off—1st, the ~~arteria medullæ spinalis transversæ~~; 2nd, the ~~meningeal~~; 3rd, the inferior cerebellar; 4th, anterior and posterior spinal. The basilar artery, formed by the union of the two vertebrals, gives off transverse branches to the pons, a small branch which enters the meatus auditorius internus, and terminates by dividing into four large vessels; the posterior cerebral and superior cerebellar of each side.

B. *Internal mammary*, which gives off—1st, the comes nervi phrenici; 2nd, the mediastinal, thymic and pericardiac branches; 3rd, the anterior intercostals; 4th, anterior perforating branches; 5th, the musculo-phrenic; and 6th, the superior epigastric.

C. *Thyroid axis*, which divides into—1st, inferior thyroid, which gives off the cervicalis ascendens; 2nd, supra-scapular, which gives off a supra-acromial branch, and then passes into the supra-spinous fossa of the scapula, over the notch; 3rd, posterior scapular, which gives off a superficial cervical branch, and then terminates in the muscles of the scapula.

D. *Superior intercostal*, supplies the two or three first intercostal spaces, which gives off the *cervicalis profunda* to anastomose with the *princeps cervicis* from the occipital.

THE AXILLARY ARTERY

Extends from first rib to the lower border of the tendon of the *teres major*. It sends off seven branches.

- A. *Acromial thoracic*.
- B. *Thoracica suprema* *superior*
- C. *Thoracica alaris*.
- D. *External mammary*, or long thoracic.
- E. *Subscapular*, which sends off an anterior and dorsal branch.
- F. *Posterior circumflex*.
- G. *Anterior circumflex*.

THE BRACHIAL ARTERY

Extends from the lower border of the tendon of the *teres major* to a finger's breadth below the bend of the elbow, and sends off four branches.

- A. *Profunda superior*, which sends off—1st, an ascending branch; and 2nd, the musculo-spiral branch. It accompanies the musculo-spiral nerve.
- B. *Nutritia humeri*.
- C. *Profunda inferior*, which accompanies the ulnar nerve.
- D. *Anastomotica magna*.

THE RADIAL ARTERY

Sends off ¹²ten branches.

A. *Recurrent radial*.—It anastomoses with the profunda superior.

B. *Muscular*.

C. *Superficialis volæ*, anastomoses with the ulnar to form the superficial palmar arch.

D. *Anterior carpi radialis*.

E. *Dorsalis carpi radialis*.

F. *Dorsalis pollicis*.

G. *Dorsalis indicis*.

H. *Princeps pollicis*.

I. *Radialis indicis*.

K. *Palmaris profunda*.

Recurrent . . .

THE ULNAR ARTERY

Sends off eight branches.

A. *Anterior recurrent*, anastomoses with anastomotica magna.

B. *Posterior recurrent*, anastomoses with inferior profunda.

C. *Interosseous*, which sends off—1st, the comes nervi mediani; 2nd, the anterior interosseous; 3rd, the posterior interosseous; 4th, the posterior recurrent; and 5th, the posterior descending branch.

D. *Muscular*.

E. *Carpi ulnaris anterior*.

F. *Carpi ulnaris posterior*.

G. *Ulnaris profunda*.—

H. *Palmaris superficialis*, which anastomoses with the superficialis volæ to form the superficial palmar arch. A long branch comes off from the ulnar or interosseous, called the comes nervi mediani; it is of uncertain size.

DEEP PALMAR ARCH.

The deep palmar arch is formed by the palmaris profunda of the radial, uniting with the arteria communicans from the ulnar; it sends off these small branches interossi, some recurrent branches, and three perforating branches.

THE SUPERFICIAL PALMAR ARCH

Is formed by the arteria palmaris of the ulna, uniting with the superficialis volæ from the radial. It sends off four branches.

A. *Branches to ulnar side of little finger.*

B. *Branch to cleft between little and ring finger.*

C. *Branch to cleft between ring and middle fingers.*

D. *Branch to cleft between middle and index fingers.*

THE THORACIC AORTA

Sends off five sets of branches.

A. *Pericardiac.*

B. *Posterior mediastinal.*

C. *Bronchial.*

D. *Œsophageal.*

E. *Intercostals*, ten in number : each divides into—1st, the posterior branches ; and 2nd, the anterior branches.

THE AORTA ABDOMINALIS

Sends off the following branches :—

A. *The two phrenic arteries.*

B. *The cæliac axis.*—From this axis arise—1st, the superior gastric artery, which divides into a superior and an inferior branch ; 2nd, the hepatic artery, which gives off the superior pyloric artery, the gastro-duodenal artery, which divides into the arteria pancreatica duodenalis, and the arteria gastro-epiploica dextra. The hepatic artery then divides into the left hepatic and right hepatic arteries, from the last of which proceeds a small branch to the gall-bladder, called arteria cystica ; 3rd, the splenic artery, which sends off the pancreaticæ parvæ, the pancreatica magna, the vasa brevia, splenic branches, and the gastro-epiploica sinistra.

C. *The superior mesenteric artery*, which gives off—1st, the colica dextra, which divides into a superior and an inferior branch; 2nd, the colica media, which divides into a right and left branch; 3rd, the ilco-colica, which divides into a superior branch, a middle branch, and an inferior branch; 4th, the mesenteric branches, from fifteen to twenty in number; and 5th, the inferior pancreatica duodenalis.

D. *Two capsular.*

E. *Two renal.*

F. *Two spermatic.*

G. *Inferior mesenteric*, which sends off—1st, the colica sinistra, which divides into an ascending branch and a descending branch; 2nd, the sigmoid artery; and 3rd, the superior hæmorrhoidal artery.

~~H. *Ureteric arteries.*~~

I. *Lumbar arteries.*

K. *Sacra media*, which gives off the fifth lumbar artery.

THE COMMON ILIAC ARTERIES

Extend from the bifurcation of the aorta, opposite the 4th lumbar vertebra, and, after a course of about two inches, divide into external and internal near the sacro-iliac symphysis; the right is usually longer than the left; they divide into two branches—viz.,

*The internal, and
External iliac arteries.*

THE INTERNAL ILIAC ARTERY

Sends off ten branches in the female.

A. *Arteria ilio-lumbalis*, which sends off—1st, ascending branches; 2nd, external branches; and 3rd, descending branches.

B. *Lateral sacral*. *middle &*

C. *Vesical*, superior ~~and~~ inferior.

D. *Middle hæmorrhoidal*.

E. *Uterine*.

F. *Vaginal*.

G. *Obturator*, which sends off—1st, the branches within the pelvis; and 2nd, branches without the pelvis.

H. *Gluteal*, which sends off—1st, a superficial branch; and 2nd, a deep branch.

I. *Ischiatic*, which sends off—1st, the coccygeal branch; 2nd, the *arteria comes nervi ischiatici*; and 3rd, the muscular branches.

K. Pudic, which sends off—1st, the external hæmorrhoidal arteries; 2nd, the superficial perineal; 3rd, the *transversalis perinei*; 4th, the *arteria corporis bulbosæ*, which gives a branch to Cowper's gland, and a branch to the *corpus spongiosum*; 5th, the *arteria corporis cavernosi penis*; and 6th, *arteria dorsalis penis*.

THE EXTERNAL ILIAC

Sends off two branches.

A. *Epigastric*, which sends off—1st, the cremasteric artery ; 2nd, the muscular artery ; and 3rd, the pubic artery.

B. *Circumflexa ilii*.

THE FEMORAL ARTERY

Extends from Poupart's ligament to an opening in the tendon of the adductor magnus, where it becomes "popliteal." It sends off the following branches :—

A. *Superficial epigastric*.

B. *Superficial pudic*.

C. *Superficial circumflexa ilii*.

D. *Profunda femoris*, which sends off—1st, the circumflexa externa, from which arise the ascending branches, the transverse branches and descending branches ; 2nd, the circumflexa interna, from which arise arterial branches to the muscles of the hip-joint, and a branch to the interior of the hip-joint ; 3rd, the perforans prima ; 4th, the perforans secunda ; 5th, the perforans tertia ; and 6th, the terminal branch.

E. *Anastomotica magna*.

THE POPLITEAL ARTERY

Lies—1st, upon posterior part of femur; 2nd, upon the ligamentum posticum Winslowii; 3rd, upon the popliteus muscle, and then divides into anterior and posterior tibial. It sends off seven branches.

A. *Superior muscular.*

B. *Articularis superior externa*, which sends off a superficial branch and a deep branch.

C. *Articularis superior interna*, which sends off a superficial branch and a deep branch.

D. *Azygos branch*, which perforates the ligamentum posticum Winslowii.

E. *Articularis inferior externa.*

F. *Articularis inferior interna.*

G. *Inferior muscular or sural.*

THE TIBIALIS POSTICA

Sends off—

A. *Muscular.*

B. *Peroneal*, which sends off—1st, the nutritialis fibulæ; 2nd, muscular; 3rd, the anterior peroneal; and 4th, the posterior peroneal.

C. *Nutritialis tibie.*

D. *Internal plantar.*

E. *External plantar.*

internal Calcaneus.
Commissary.

THE TIBIALIS ANTICA

Passes through the interosseous space, and sends off the following branches:—

- A. *Muscular.*
- B. *Recurrent tibial.*
- C. *Internal malleolar.*
- D. *External malleolar.*
- E. *Tarsal branch.*
- F. *Metatarsal branch.*
- G. *Arteria pollicis.*
- H. *Arteria communicans.*

Interosseus

Dorsalis
Pavio

THE PLANTAR ARCH

Is formed by the external plantar artery uniting with the arteria communicans of the anterior tibial. It sends off two sets of branches:—

- A. *Arteriæ perforantes.*
- B. *Arteriæ digitales.*

THE PULMONARY ARTERY

Divides into two branches:—

- A. *Right pulmonary.*
- B. *Left pulmonary.*

VEINS.

The veins are not so uniform in their distribution as the arteries. Besides the numerous superficial veins which ramify on the skin, one or two are found to accompany each artery. In the extremities there are generally two to each artery, and in these situations they receive the name of *venæ comites*. When, however, an artery is of great size, as the femoral or the axillary, it is accompanied but by one vein, which receives the same name as the artery.

VEINS ON THE HEAD AND NECK.

The veins which accompany the branches of the internal maxillary artery form the internal maxillary vein.

External jugular vein, formed by the junction of the internal maxillary and one temporal vein in the parotid gland, descends obliquely backwards, and joins the subclavian vein: after crossing the sterno-mastoid muscle it receives the supra and posterior scapular veins.

Internal jugular vein, commences at the termination of the lateral sinus, descends along the outer side of the common carotid artery, and joins the subclavian vein at the sternal extremity of the clavicle. It receives the superior thyroid, lingual, facial, occipital, and ascending pharyngeal veins.

Anterior jugular vein, descends in front of neck and opens into the subclavian vein.

VEINS OF THE SUPERIOR EXTREMITY.

The Cephalic vein is formed by the union of several veins from the back of the hand. It ascends along the radial side of the extremity, and passing along the interval between the pectoralis major and deltoid muscles, terminates in the *axillary vein*.

The Basilic vein commences by a small vein from the little finger (*vena salratella*), ascends along the inner side of the extremity, and terminates in the axillary vein, or joins one of the *venæ comites* which accompany the brachial artery.

The Median vein commences at the fore part of the wrist and hand, ascends along the anterior aspect of the forearm, and at the elbow terminates by dividing into two branches. One of these joins the basilic vein, and is named the *median basilic*; the other joins the cephalic vein, and is named *median cephalic*.

The Axillary vein, formed by the union of the veins just described, and by the *brachial venæ comites*, ascends in front of the axillary artery, receiving the *thoracic veins*, and passes beneath the clavicle, where it terminates in the subclavian vein.

The Subclavian vein passes inwards over the

anterior scalenus muscle, receives numerous veins from the neck and shoulder; also the *external jugular* and *vertebral veins*, and joins the internal jugular vein behind the sternal extremity of the clavicle.

Vena innominata, formed by the union of the internal jugular and subclavian veins, on the right side, is very short, and descends into the thorax; the left vena innominata, which is much longer, enters the thorax in an oblique direction in front of the trachea to join the right vein, and in its course receives the *inferior thyroid veins*, and veins from the anterior mediastinum. By the union of the venæ innominatæ is formed the

Vena cava superior, which descends in front of the right pulmonary vessels, enters the pericardium, and opens into the right auricle.

VENA AZYGOS MAJOR

Commences on the first lumbar vertebra by one or two small veins from the renal or from the inferior vena cava, gains the posterior mediastinum by passing through the aortic opening of the diaphragm, ascends along the right side of the bodies of the dorsal vertebræ, curves forwards over the root of the right lung, and terminates at the posterior aspect of the superior vena cava, as this vessel is entering the pericardium. In its course it receives

the lower intercostal veins of the right side, œsophageal veins, the azygos minor, right bronchial, and sometimes the right superior intercostal veins. It has a few imperfect valves.

Vena azygos minor commences from one of the lumbar veins, passes through the aortic opening of the diaphragm, and after receiving the lower intercostal veins of the left side, joins the vena azygos major opposite the sixth dorsal vertebra.

All the veins of the upper extremity which accompany the large arteries are situated on a plane anterior to their respective arteries.

VEINS OF THE INFERIOR EXTREMITY.

Internal saphena vein commences at the inner part of the foot, ascends along the inner side of the leg and knee, behind the inner condyle, becomes more anterior upon the thigh, and, reaching to within about two inches of Poupart's ligament, passes through the saphenous opening of the fascia lata, and joins the femoral vein.

External saphena vein commences at the outer part of the foot, ascends along the back part of the leg and ham, and joins the popliteal vein.

Both these veins are superficial, and in their course receive several veins from the integuments.

Deep veins of the leg, two veins (*venæ comites*)

accompany each artery in the leg, and terminate in the following:—

Popliteal vein: this vessel accompanies the artery of the same name, and having received the external saphena vein, and the veins of the knee, terminates in the femoral vein. Its coats are very thick.

Femoral vein accompanies the femoral artery, and having received the profunda vein, the internal saphena vein, and a few muscular veins, passes beneath the crural arch, and ends in the external iliac vein.

External iliac vein accompanies the external iliac artery.

Internal iliac vein is formed by the union of the veins which accompany the branches of the internal iliac artery, and joins the external iliac vein at the sacro-iliac symphysis.

Common iliac vein, formed by the union of the internal and external iliac veins, joins its fellow at the right side of the body of the fourth lumbar vertebra to form the inferior vena cava.

Inferior vena cava ascends along the right side of the bodies of the lumbar vertebræ, behind the liver, and passes through the quadrilateral opening in the tendon of the diaphragm, and opens into the right auricle of the heart at its lower and back part. It receives the middle sacral, the right spermatic vein, the renal and capsular veins, the venæ

cavæ hepaticæ, the phrenic veins, and the lumbar veins.

The veins which accompany the large arteries of the lower extremity lie posterior to their respective arteries, except the renal and the profunda veins.

VENA PORTÆ

Commences on the back of the rectum by the superior *hæmorrhoidal* vein, ascends towards the mesocolon, and unites with the *splenic vein* , which has been previously joined by the *inferior mesenteric vein* , behind the pancreas, and, after receiving veins from the stomach, duodenum and pancreas, the common trunk joins with the superior mesenteric veins, to form the vena portæ. The vena portæ ascends to the right side, enclosed in the capsule of Glisson, and reaches the transverse fissures of the liver, where it divides into two branches : these enter the liver, ramify through its substance like an artery, and its blood is returned to the inferior vena cava by the venæ cavæ hepaticæ, which are three or four in number, and open into the cava as this vessel is entering its opening in the diaphragm.

THE DIGESTIVE APPARATUS.

THE MOUTH.

This cavity is bounded superiorly by the hard and soft palate, inferiorly by the tongue and the reflections of mucous membrane from it to the gums, and laterally by the cheeks. Its anterior opening, which forms the commencement of the digestive canal, corresponds to the lips; and posteriorly it communicates with the pharynx through the opening called isthmus faucium, the boundaries of which are the soft palate and uvula superiorly, the tongue inferiorly, and the pillars of the palate and tonsils laterally. Within the mouth we observe the opening of the three salivary glands and follicles, and the teeth of each side. The parotid gland opens by a single orifice opposite the second superior molar tooth; the submaxillary gland of each side, by a single orifice at the floor of the mouth, by the side of the reflection of mucous membrane called frænum linguæ, and the third salivary gland or sublingual by several small orifices (eight or ten) on each side of the frænum linguæ. Is lined with squamous epithelium.

THE TEETH.

The number of teeth in the adult is thirty-two, sixteen in each jaw; and to distinguish them from the teeth of the child they are called *permanent*.

They are divided into eight *incisors*, four *canine*, eight *bicuspid*s, and twelve *molars*. The two last molars do not appear until late in life, and hence have been called the *wisdom* teeth. They are, however, sometimes wanting.

In the child the number of teeth is only twenty, and are called milk, deciduous, or temporary teeth.

They are divided into eight *incisors*, four *canine*, and eight *molars*.

THE TONGUE

Is a solid muscular organ, occupying the floor of the mouth, and is covered with mucous membrane. Posteriorly it is thick, and attached to the hyoid bone, anteriorly it is free and lies behind the teeth. The upper surface or dorsum is covered for its front half with papillæ, circumvallatæ, fungiform and filliform. The circumvallate, seven to twelve, are arranged like the letter V, the posterior, or one forming the apex, lies in front of the foramen cæcum ; the fungiform, more numerous, are deep red, round and blunt ; the filliform, more numerous still, are small tapering processes distributed over the whole surface of the tongue. The muscles forming the tongue are extrinsic and intrinsic ; the former attach it to other bones ; the latter are placed within it, and are, the superficial and inferior lingualis, the transverse and vertical fibres.

The nerves are the gustatory, which supplies the papillæ, and anterior two-thirds of the tongue, the glosso-pharyngeal, which supplies the base of the tongue and papillæ circumvallatæ, and the hypoglossal which supplies the muscles.

THE TONSILS

Are placed between the anterior and posterior palatine arches, separated from the internal carotid artery by the superior constrictor. Their surface is convex, and marked by the orifices of about fifteen mucous crypts; their structure is mainly lymphoid.

SALIVARY GLANDS

Are three in number—viz., the Parotid, the Sub-maxillary, and the Sub-lingual.

Parotid gland, the largest of the three, is bounded superiorly by the zygoma, posteriorly by the mastoid process and sterno-mastoid muscle, and advances on the side of the face, partly resting upon the masseter muscle. It sends off deep processes, which fill the posterior part of the glenoid cavity, the fossa between the ear and perpendicular process of the lower jaw, and the intervals between the pterygoid, digastric, and styloid muscles; it often unites with the sub-maxillary gland. Its duct (*duct of Steno*) passes across the masseter

muscle, pierces the buccinator muscle, and opens into the mouth opposite the second superior molar tooth.

A prolongation (*socia parotidis*) is found between Steno's duct and the zygoma, the duct of which unites with that of the parotid gland.

In the substance of the gland are found, in the following order, one or more lymphatic glands, the pes anserinus, joined by branches from the great auricular and temporal-auricular nerves, the internal maxillary and temporal veins joining to form the external jugular, and, lastly, the division of the external carotid into temporal and internal maxillary arteries.

Sub-maxillary gland, placed in the digastric space, and covered by the skin, platysma myoides muscle, and superficial fascia, is of oval figure, and much smaller than the parotid. Its duct (*Whartonian*) turns round the posterior edge of the mylo-hyoid muscle, and runs forwards and inwards, upon the hyo-glossus muscle, towards the *frænum linguae*, at the side of which it opens into the mouth.

Sub-lingual gland, placed between the mucous membrane of the mouth and the mylo-hyoid muscle, is the smallest of the salivary glands and opens by several small ducts (*Rivianian*), which perforate the mucous membrane reflected from the side of the tongue.

THE PHARYNX

Is a musculo-membranous bag of conical shape, extending by its base from the posterior part of the mylo-hyoid ridge and base of the skull to the posterior aspect of the cricoid cartilage, where it terminates in the œsophagus. It is connected by its posterior wall to the vertebræ by loose cellular tissue, præ-vertebral fascia, and interiorly it corresponds to the mouth and larynx.

On laying open the cavity of the pharynx by a perpendicular incision along its posterior median line the external mucous lining of the bag will be exposed, and the following openings — viz., superiorly, one on either side of the mesial line, the openings of the posterior nares; more externally, one on each side the openings of the Eustachian tubes; inferior to these is the opening of the mouth into the pharynx, or the isthmus faucium; posterior and inferior to the tongue is the upper opening of the larynx, and, lastly, the opening of the pharynx into the œsophagus.

THE ŒSOPHAGUS,

About nine inches in length, commences about the fifth cervical vertebra, and extends from the termination of the pharynx to the stomach; above it is placed between the vertebræ and the trachea,

inclines at the inferior part of that tube to the left side, and passes behind its left bifurcation to reach the posterior mediastinum. In the mediastinum it descends forwards, and winding round the thoracic aorta passes through the oval muscular aperture of the diaphragm, to terminate in the stomach opposite the 9th dorsal vertebra. Its walls are composed of three layers, muscular, areolar, and mucous ; its muscular coats consist of an external longitudinal and an internal circular ; its upper half is composed of striped, its lower half of unstriped muscular fibres. The mucous membrane is covered with squamous epithelium.

THE STOMACH,

A large pyriform musculo-membranous bag, situated in the epigastric and left and right hypochondriac regions, communicating at one extremity with the œsophagus, and at the other with the duodenum.

Connexions.—Its large extremity, or *fundus*, to the spleen by the gastro-splenic omentum ; its upper, concave, small edge, to the liver, by the gastro-hepatic omentum ; and its lower, convex, large edge, to the colon, by the gastro-colic omentum. Its œsophageal or cardiac orifice, situated between the fundus and lesser curve, connects it to the diaphragm, and its pyloric orifice to the duo-

denum. The superior-anterior surface of the stomach looks towards the diaphragm, ribs, and left lobe of the liver; the posterior-inferior surface towards the meso-colon.

The stomach is composed of three tunics, connected by cellular tissue, an external peritoneal coat, an internal mucous coat, and between both the muscular coat. The muscular fibres of the stomach consist of three sets: the longitudinal are seen along the edges or curves, the oblique on the fundus, and the circular are well developed at the centre of the organ, and at its pyloric orifice. The mucous coat, smooth, and of light pink colour, is thrown into folds (*rugæ*), which disappear when the organ is distended. The mucous surface is marked with innumerable polygonal ridges, which enclose irregular spaces, *alveoli*, of about $\frac{1}{150}$ th of an inch in diameter. Numerous round dots are seen in the spaces which are the orifices of tubular gastric glands. At the cardiac end they are tubular, but at the pyloric end they are branched. Besides these there are glands called peptic glands, situated in the deeper structure of the pyloric end. At the pyloric orifice the mucous membrane is thrown into a circular fold, which forms an imperfect valve between the stomach and duodenum. It is lined with columnar epithelium.

SMALL INTESTINES

Are divided into duodenum, jejunum, and ileum.

Duodenum, the shortest portion of the small intestines, forms a curve in the concavity of which is situated the head of the pancreas ; it is divided into a superior transverse portion, a middle perpendicular portion, and an inferior transverse portion. The transverse portion mounts upwards and to the right to the under surface of the liver ; the descending extends as low as the right side of the body of the third lumbar vertebra ; the transverse portion crosses to the left side of the body of the second lumbar vertebra, and then opens into the jejunum. The superior part is covered by peritoneum on both its surfaces, and on this account is more movable than the perpendicular or inferior portions, which are only covered on their anterior surface by this membrane.

Besides the numerous mucous glands which open on its interior surface, the pancreatic duct and the common biliary duct enter at its perpendicular division, either by a common aperture, or in close proximity. This intestine differs not only in these particulars from the rest of the small intestines, but also in being much larger, more dilatable, more fixed to its position, in having a greater number of *valvulæ conniventes* (or circular folds of

the mucous membrane), and in its muscular fibres being much stronger. It also contains Brunner's glands, which are small conglomerate glands near the pylorus.

Jejunum and Ileum, form the longest part of the intestinal tube, being in general from 19 to 20 feet in length; the upper two-fifths are given to the jejunum, and the remainder to the ileum, but there is no definite limit between them, as the intestines run into each other insensibly, and from the duodenum the remainder of the small intestinal tube gradually diminishes in thickness, has fewer valvulæ conniventes, and exhibits less vascularity; so much so, that the termination of the ileum is much thinner and paler than the upper part of the jejunum, and it is in these situations only that the differences between both are marked and striking. The mucous membrane of the small intestine is studded with glands of two orders—viz., the *glandulæ solitariae*, and the *glandulæ agminatae*. The solitariae are disseminated like granules over the mucous membrane, and the agminatae are placed in oval clusters. Both these sets of glands are termed Peyer's glands. In the small intestines are also Lieberkühn's glands and small vascular processus villi. The fibres of the muscular coat of the small intestines take a circular and longitudinal direction, the latter being placed externally.

LARGE INTESTINE,

Divided into the cæcum, colon, and rectum, forms about one-fifth of the intestinal canal. It differs from the small intestine in its great size, in being sacculated, in having small processes along its entire course, called *appendicés epiploicæ*, in presenting three well-defined longitudinal bands, in being thinner, and in having no *valvulæ conniventes* or villi. It is composed of an external serous coat, an internal mucous coat, and, between both, a muscular coat. The fibres of the muscular coat are longitudinal and circular; the former are collected into three bands, which being shorter than the intestine throw it into *sacculi*: the latter resemble the circular fibres of the small intestine.

Cæcum, or *caput coli*, placed in the right iliac fossa and connected to the iliacus and psoas muscles, is fixed in its situation by the peritoneum, which only covers it anteriorly and somewhat laterally; it receives at its inner side the ileum, which terminates in its cavity by a slit-like opening, which is guarded by two valves; these, in health, allow the transit of alimentary and excremental matter from the ileum to the colon, but not in the reverse direction. The inferior valve or *ileo-cæcal* is the larger, and placed obliquely; the superior or *ileo-colic* is smaller, and rather horizontal; both are united at

their extremities, forming the *commisures*. The *appendix vermiformis*, is a small diverticulum which proceeds from the posterior part of the cæcum ; it is the size of a goose-quill in diameter, and from three to five inches in length ; its orifice of entrance into the cæcum is guarded by a small valve ; the cæcum has no *valvulæ conniventes*, but is thrown into irregular *sacculi* by the three longitudinal bands of muscular fibres.

The colon extends from the cæcum to the rectum, and is divided into four portions—viz., the right or *ascending colon*, the middle or *transverse*, the left or *descending*, and the *sigmoid flexure*.

The rectum extends from the sigmoid flexure of the colon to the anus ; its upper third is wholly covered by peritoneum, its middle third is only covered by this membrane upon its anterior aspect and sides, and its inferior third has no peritoneal covering. In the male subject the antero-inferior aspect of the rectum is connected to the inferior surface of the bladder, the *vesiculæ seminales*, and the prostate gland, and in the female to the uterus and vagina. The rectum has the longitudinal fibres scattered over its whole surface, and is not *sacculated* like the other parts of the large intestine. At the anal orifice there are a number of large veins which communicate with the superior *hæmorrhoidal vein*, and thus indirectly with the portal system.

LIVER,

Situated in the right hypochondriac, the epigastric, and partly in the left hypochondriac regions, is the largest gland in the body, and weighs between fifty and sixty ounces. It presents an upper convex surface, a lower irregularly concave surface, a posterior thick margin attached to the diaphragm, and an anterior inferior margin which is free. The upper surface is unequally divided by the falciform ligament into a right and left lobe. The inferior surface presents the following fissures and depressions.

1. *Longitudinal fissure*, extends from a notch in the anterior thin edge of the liver backwards and upwards, defining the boundary between the right and left lobes of the organ ; it crosses the transverse fissure at right angles, and is continued to the fissure of the vena cava by a canal—*fissure of the ductus venosus*—often concealed in the substance of the liver. As far as the transverse fissure it contains the remains of the obliterated umbilical vein ; beyond that point, the obliterated ductus venosus.

2. *Transverse or portal fissure*, extends from the longitudinal fissure into the right lobe of the liver ; it contains the trunks of the right and left hepatic arteries, the trunk of the portal vein, the hepatic extremities of the biliary ducts, the hepatic plexus of nerves and absorbents.

3. *Fissure of the vena cava*, situated to the right of the horizontal fissure and behind the transverse fissure, forms the right boundary of the lobulus Spigelii.

4. Depression for the gall-bladder, situated to the right of the lobulus quadratus.

5. A broad notch in the posterior thick edge of the liver, which corresponds to the right crus of the diaphragm.

Lobes of the liver.—1st, right lobe, the largest; 2nd, left lobe, separated from the right by the longitudinal fissure; 3rd, lobulus Spigelii, bounded in front by the transverse fissure, and placed between the ductus venosus and vena cava; 4th, lobulus caudatus, extending from the lobulus Spigelii along the right lobe, and lying posterior to the transverse fissure; 5th, the lobulus quadratus, which is bounded behind by the transverse fissure, to the left by the horizontal fissure, to the right by the gall-bladder, its anterior edge being free.

Vessels of the liver.—1st, the hepatic artery; 2nd, the vena portæ; 3rd, the venæ cavae hepaticæ; 4th, the biliary or hepatic ducts; and 5th, the absorbents. The hepatic artery is the nutrient vessel of the liver; its terminal branches open into the subdivisions of the vena portæ. The vena portæ conveys, like an artery, the blood for secretion of the liver. The biliary ducts commence amongst the lobular veins.

Ligaments of the liver.—Besides the liver being invested with a thin capsule, it is also covered by peritoneum, which forms five of its ligaments—viz., 1st and 2nd, a right and left lateral, triangular in form, and connecting the right and left lobes to the diaphragm; 3rd, a suspensory or falciform ligament, which connects its upper convex surface to the right rectus muscle, and to the diaphragm; 4th, the coronary ligament, which connects the superior thick border to the diaphragm; and 5th, the obliterated umbilical vein (*ligamentum teres*), which extends obliquely from the umbilicus upwards and backwards to the anterior portion of the horizontal fissure.

Structure.—The liver substance is composed of a multitude of polyhedral lobules, of about half a line to a line in diameter. Between the lobules are found small branches of the vena portæ, hepatic artery, and biliary ducts, enclosed in a common sheath derived from Glisson's capsule: these veins are called *interlobular*, from which are derived numerous branches, penetrating the lobule from its circumference to its centre. The plexus thus formed ramifies between the hepatic cells in the lobule, and is called the lobular plexus; the branches of which converge to the centre of the lobule and terminate in a single central vein, the *intralobular vein*. The intralobular vein opens into the sublobular vein, upon which the lobule rests,

and this again terminates in an hepatic vein which opens into the vena cava inferior. The hepatic artery runs along with the branches of the portal vein and gives off vaginal, capsular and interlobular, which supply the capsule and the lobules. The interstices between the blood-vessels are filled with hepatic cells; and among the cells may be recognised a minute and close network of channels, *biliary capillaries*, which are the commencements of the bile ducts. The ducts join with other ducts, till they collect into two large ducts, the right and left hepatic.

Gall-bladder, pyriform in shape, and composed of an internal mucous coat, a proper fibrous coat, and a partial serous covering, is lodged in a depression on the under surface of the right lobe of the liver. Its large extremity, or *fundus*, is directed downwards and forwards; its upper extremity terminates in the *cystic duct*, about an inch and a half in length, which unites with the *hepatic duct*, formed by the union of the right and left ducts from the corresponding lobes of the liver. The common biliary duct thus formed by the cystic and hepatic ducts is called the *ductus communis choledochus*, which is about five inches in length, and conveys the bile to the descending part of the duodenum.

PANCREAS,

A flattened elongated gland from five to six inches in length, similar in its formation to the salivary glands. It consists of a left *caudal extremity*, situated in the lower part of the left hypochondrium, a *body* which crosses, anterior to the left crus of the diaphragm, the aorta and the vena portæ, to the right side; and a right extremity (*the head*), which is the largest part of the gland, and which is surrounded by the duodenum. Its duct, of a whitish colour, extends along the centre of the gland from left to right, but lying near its anterior aspect; receiving the small ducts from the acini of the pancreas, it finally opens into the duodenum, close to the ductus communis choledochus, which it sometimes joins.

THE SPLEEN

Is connected to the large extremity of the stomach by peritoneum and blood-vessels, and situated between the stomach and the ribs of the left side; is of deep-blue venous colour, and varies in weight from six to fifteen ounces. It is oval in shape, convex on its outer, and hollowed out on its inner to form the *hilus*: and is covered by fibrous, elastic, and peritoneal coats. The fibrous—*tunica propria*—covering sends down partitions (*trabeculae*)

into its substance, forming interspaces in which the spleen pulp is contained. *The pulp* is of reddish-brown colour, and consists of red cells about the size of red blood cells, nucleated cells, free nuclei, and caudate cells. The pulp consists of numerous branched connective tissue corpuscles, which ultimately forms a still finer reticular tissue. The corpuscles contain nuclei, and occasionally yellow pigment granules, and blood-cells in every stage of metamorphosis. Between the cells are white blood-cells in larger quantity than in healthy blood.

The arteries of large size divide on the fibrous septa, and terminate either directly in the veins or intermediately in lacunar spaces. At the point of division of the arteries and connected with their sheaths are numerous vesicular lymphoid bodies, *Malpighian corpuscles*, which contain whitish fluid, and which are expansions of the lymphoid tissue, which forms a thick sheath along the blood-vessels. It has no excretory duct.

THE SUPRA-RENAL CAPSULES

Are two flattened, triangular bodies placed above the kidneys. On the anterior and inner aspect is a concavity, the hilus, which transmits the supra-renal artery. They are over an inch in length, and weigh from one to two drachms. On section, its

structure presents two parts, cortical and medullary ; the cortical is hard, and composed of fibrous stroma interspersed with granular cells ; the medullary consists of a thinner and more delicate reticular stroma, in which are abundant cells. destitute of oil globules.

URINARY APPARATUS.

THE KIDNEYS,

Two glandular organs of oval form, situated behind the peritoneum in each lumbar region, lying upon the diaphragm, psoas magnus and quadratus lumborum muscles, and enveloped in a thick layer of adipose tissue. The right kidney, which is rather lower than the left, is below the liver, above the cæcum, and behind part of the duodenum, and the ascending colon ; the left being bounded above by the spleen, below by the sigmoid flexure of the colon, and anteriorly by the descending colon. The extremities and outer border of each kidney are convex, whilst the inner margin presents a concave aspect called *the hilus*, which contains the trunks of the blood-vessels and its excretory duct, entering in the following order—the veins anterior, the arteries behind these, and the ureter obliquely behind both. Besides the adipose capsule which envelopes each kidney, it also has a proper fibrous

coat, which adheres loosely to its outer surface, and sends prolongations at the hilus into its interior, as far as the calyces. Each weighs from four to six ounces. When a section is made through the kidney, its structure is seen to consist of two kinds—the *cortical* and the *medullary*. The latter consists of from eight to sixteen conical masses, the *pyramids of Malpighi*, their bases being directed towards the surface, and their apices, *papillæ*, towards the *sinus*, which is a continuation of the hilus. The cortical substance, placed externally, dips down between the pyramids, and is of brownish-red colour, from a line and a half to two lines in thickness. The summits of the *papillæ* are studded with a number of small orifices, which are the terminations of the *tuberi uriniferi*. These tubes, traced up through the pyramids, run a straight course, branching dichotomously at very acute angles, and at the bases of the pyramids continue still a straight direction for a short distance, *pyramids of Ferrein*, when they become tortuous and convoluted, and form the cortical substance.

The pelvis is the dilated funnel-shaped sac of the ureter.

The infundibula are three funnel-shaped tubes formed by the division of the pelvis.

The calyces are small tubes, formed by the subdividing of the infundibulum, and each embraces one or two *papilla*.

Papillæ is the name given to the nipple-like apices of the pyramidal fasciculi. Each papilla presents numerous minute openings, the apertures of the tubes of which the cones are composed; these apertures are not so numerous as the tubes, several of which are united in one common orifice.

Tubuli uriniferi commence in the cortical portion by round dilatations; they then run a tortuous course, narrow somewhat in diameter before entering the pyramids, where they run a straight course as far as the papilla: thence they return, forming the *looped tubes of Henle*, to the cortical substance, become again tortuous, and terminate in a *collecting tube*. These tubes unite to form an *excretory tube*, which ends at the papilla.

Malpighian bodies, $\frac{1}{120}$ th of an inch in diameter, found only in the cortical portion, are formed by the dilatation of the uriniferous tube. An afferent artery enters it and breaks up into a vascular network (*glomerulus*), terminating in an efferent vein which emerges close to the artery, and which forms a secondary plexus over the tubulus uriniferus. The aqueous part of the urine is excreted by the Malpighian bodies; the saline parts are separated from the blood in the venous capillaries, which convey the blood back to the renal vein.

The ureters extend from the termination of the pelvis of either kidney to the bladder. Each ureter, about eighteen inches long, and of the diameter of a

moderate sized quill, passes behind the peritoneum, lying anterior to the psoas magnus muscles and to the iliac vessels, and reaching the inferior and posterior part of the bladder, passes obliquely between its coats and perforates its interior at the outer angle of its trigone.*

THE URINARY BLADDER.

This musculo-membranous viscus, when moderately distended, is of ovoid figure, and occupies the lower region of the pelvis, behind the symphysis pubis, and anterior and superior to the rectum in the male, and the uterus and vagina in the female.

Ligaments of the bladder are divided into *true* and *false*. The true ligaments are five in number—viz., two anterior and two lateral, and a superior. The anterior, white and cord-like, extend from the posterior surface of the pubes to the front of the prostate and neck of the bladder; the latter, thinner and wider, are attached to the sides of the prostate and bladder; both are reflections of pelvic fascia: the superior is formed by the urachus. The false ligaments are five in number—viz., two posterior, two lateral, and one superior, and are formed by the reflections of the peritoneum.

* To gain a view of the parts just described, a perpendicular section of the gland should be made from its convex to its concave margin.

The regions of the bladder are divided into six—1st. *The superior region*, to which are attached the urachus and obliterated umbilical arteries. 2nd and 3rd. *The lateral regions*, on which the vesical fascia of either side passes. 4th. *The anterior region*, the aspect of which looks towards the recti muscles, the pubes, and the triangular ligament of the urethra. 5th. *The posterior region*, the aspect of which looks towards the rectum in the male, and the uterus in the female. 6th. *The inferior region*, or *fundus*, which rests on the vesiculæ seminales, the prostate gland, and the rectum in the male, and on the uterus and vagina in the female.

Coats of the bladder.—Besides the partial peritoneal covering which invests all the posterior region and the posterior parts of the upper and lateral regions, there are also three *proper* coats: 1st. *The muscular*, placed externally, the fleshy fibres of which take two directions; the external run longitudinally; (the anterior and superior fibres being stronger, have been distinguished by the name of *detrusor urinæ*;) deep fibres immediately in connexion with the mucous coat, are circular and best developed around the neck of the bladder. 2nd. *The cellular coat*; and 3rd. *The mucous*, which is exposed on opening the bladder. This coat is in general thrown into rugæ by the projection of the muscular fibres. It is lined with tessellated epithelium.

The trigone, or *vesical triangle*, is the name given to a smooth space enclosed between the openings of the ureters into the bladder and the vesical orifice of the urethra. The mucous membrane here is very closely connected with the muscular layer.

The uvula is a small duplicature of the mucous membrane on the under surface of the vesical orifice of the urethra, and corresponds to the third lobe of the prostate gland.

The *urethra*, which terminates the urinary apparatus in the male, being more connected with the reproductive organs, we shall defer its consideration for the present.

THE PERITONEUM,

The largest serous membrane in the body, lines the parietes of the abdomen, and invests almost all the abdominal viscera ; like all serous membranes, it is distinguished into two layers, a *parietal* and a *visceral*. The abdominal parietes being divided by a transverse incision corresponding to the umbilicus, the uninterrupted continuity of the peritoneum, and the different productions it forms in its course, may be thus demonstrated :—lining the inner surface of the upper section of the abdominal parietes, it ascends to the margin of the thorax, and lines the inferior surface of the diaphragm ; from this muscle it is reflected on the spleen on the left side, and on

the liver on the right side, forming its ligaments (*vide ligaments of liver*). From the transverse fissure of the liver, the two layers which cover the convex and concave aspects of this gland meet, and are conducted by the hepatic vessels to the lesser curvature of the stomach, thus forming the *gastro-hepatic omentum*, which contains the hepatic artery, portal vein, and biliary ducts, surrounded by a fibrous structure called Glisson's Capsule. The artery lies to the left, the ductus communis choledochus to the right, and the portal vein between and behind. At the lesser curve of the stomach the two laminæ of the gastro-hepatic omentum separate and enclose this organ, passing from its left extremity to the spleen, thus forming the gastro-splenic omentum; at the great curve of the stomach, and lower extremity of the spleen, the two laminæ again meet, and descend in front of the colon and the small intestines to the lower part of the abdomen; they then turn upon themselves backwards, and ascend, forming the great omentum, to the transverse arch of the colon, where they separate to enclose this intestine. Having enclosed the colon, the layers again unite and form the transverse meso-colon, which passes backwards to the spine; having arrived at the spine, the two laminæ separate into a descending and an ascending layer; the descending layer passes into the lumbar regions, where it is reflected upon the ascending and descending

colon, forming the right and left lumbar meso-colon : it attaches itself to the left sides of the bodies of the lumbar vertebræ, forming the anterior lamina of the root of the mesentery ; from this fixed point it is continued around the jejunum and ileum, forming the peritoneal coat of these intestines, and returns again to the spine, forming the posterior lamina of the root of the mesentery. This layer of the transverse meso-colon, having thus formed the mesentery, still pursues its descending course, and passes into either iliac region, and into the pelvis ; on the right it attaches the cæcum to the right iliac fossa, thus forming the meso-cæcum ; on the left side it attaches the sigmoid flexure of the colon to the left iliac fossa, forming the sigmoid meso-colon ; and in the middle it connects the upper portion of the rectum to the upper and anterior part of the sacrum, forming the meso-rectum. Still pursuing its course downwards, and covering the upper and anterior aspect of the middle third of the rectum, it is at length reflected on the posterior surface and sides of the bladder to the superior region of this viscus, from which, and from the iliac fossa, it is reflected on the inner surface of the lower section of the abdominal parietes to the transverse incision, from the upper edge of which the description was commenced. Having thus traced the descending layer of the transverse meso-colon, the continuity of the ascending layer remains

to be noticed :—ascending in front of the inferior and middle portions of the duodenum and of the pancreas, it is conducted to the diaphragm by the vena cava, where it becomes continuous with the peritoneum, which has been reflected from the posterior aspect of the liver.*

Foramen of Winslow.—By this opening the cavity which is between the layers of the great omentum communicates with the general peritoneal cavity of the abdomen. It is of oval form, being bounded anteriorly by the gastro-hepatic omentum, posteriorly by the ascending layer of the meso-colon, superiorly by the liver, and inferiorly by the duodenum.

Inguinal pouches.—As the peritoneum is ascending on the lower part of the abdominal parietes, it is thrown into four pouches, two on either side, by the obliterated hypogastric artery. The *external* pouch, between the ilium and hypogastric artery, is the largest, and corresponds to the internal

* This, the usual description of the peritoneum, leaves unexplained the way in which the hepatic vessels reach the liver without perforating the membrane. This point can be understood only by referring to the history of the development of the fœtus, in which the intestinal tube, nearly vertical, is bound to the spinal column by two folds of peritoneum, between which lie the aorta and its branches. When the viscera assume the position known in the adult, it is impossible to trace all the peritoneal folds.

abdominal and the femoral rings; the *internal* corresponding to the external ring.

In the female the peritoneum passes from the rectum on the upper and back part of the vagina, from which it ascends on the uterus, forming on each side its broad ligaments, and is reflected from the anterior part of the uterus to the back of the bladder.

MALE ORGANS OF GENERATION.

THE COVERING OF THE TESTES.

The scrotum, a pouch of the common integument, is of reddish-brown colour, slightly studded with hairs and sebaceous follicles, presenting in the median line a ridge, called the *raphé*, on each side of which it is thrown into rugæ.

The dartos, composed of areolar tissue mixed with unstriped muscular fibres.

The spermatic fascia is mixed with the dartos, and is derived from the pillars of the external abdominal ring.

The cremasteric fascia is a thin muscular covering derived from the cremaster muscle.

The infundibuliform fascia, derived from the fascia transversalis during the descent of the testes.

Septum scroti.—This partition, which divides the scrotum into two, is formed by the dartos and superficial fascia, these membranes being attached to the raphé, and from thence ascending between the testes to the penis.

PROPER COATS OF EACH TESTIS.

Tunica vaginalis.—A serous membrane, one layer covering the testis, called *tunica vaginalis testis*, the other lining the scrotum, called *tunica vaginalis scroti*. When the tunica vaginalis scroti is cut open, its continuity with the visceral layer may be demonstrated by tracing the membrane, when it is seen to be reflected on the side and front part of the epididymus and testis, forming a pouch between these bodies and also for a short distance on the front aspect of the cord.

Tunica albuginea, a strong fibrous investment of opaque white colour, which forms the proper capsule of the gland. From its inner aspect there is reflected into the back part of the testis an imperfect septum called the *corpus Highmorianum*: from the free edge of this proceed fibrous bands, trabeculæ, forming interspaces which contain the conical bundles of the tubuli seminiferi.

Tunica vasculosa, a vascular layer beneath the tunica albuginea, and sends in branches to supply the testis.

THE TESTICLES

Are two in number, of oval form, are contained in the scrotum, and are also enveloped by the tunics already described. The interior of the gland is divided into a number (250) of small lobes of pyramidal form, their apices being towards the corpus Highmorianum. Each lobe is composed of two or three convoluted tubes, tubuli seminiferi, which average in length about two feet and a half.

Tubuli seminiferi are numerous small yellow tubes, which form the body of each testicle. They are very long and tortuous, and arranged in conical fasciculi, which are separated from each other by fibrous bands, derived from the tunica albuginea.

Vasa recta, from twenty to thirty in number, are formed by the union of the tubuli seminiferi, and are contained between the layers of the corpus Highmorianum: these form the *rete testis*.

Vasa efferentia, twelve to fifteen in number, are formed by the union of the vasa recta. These tortuous vessels pierce the tunica albuginea, arrive at the head of the epididymus, and by their union form the vas deferens. They are here called "conivasculosi."

Vas deferens, or *seminal excretory duct*, is eighteen inches in length, and is folded on itself by innumerable turns for the first part of its course.

By its convolutions it forms, with the vasa efferentia, the *globus major*, or head of the *epididymis*, which is situated at the upper part of the body of the testicle ; still convoluted, it passes downwards, forming the body of the epididymis, which is narrow, and placed at the posterior part of the body of the testicle, and arriving at the inferior part of the gland it forms the *globus minor*, or tail of the epididymis. The vas deferens, having thus formed the epididymis, escapes from the *globus minor*, and having increased in size and density, ascends along the inner aspect of this body, until it becomes connected to the spermatic vessels and cremaster muscle ; it then passes through the external abdominal ring and the inguinal canal, and having passed through the internal abdominal ring, it separates from the spermatic vessels, and is conducted by the false lateral ligament of the bladder to this viscus, along the side and inferior part of which it runs, lying internal to its corresponding vesicular seminalis. It here approaches its fellow of the opposite side, and both ducts, becoming flattened, arrive at the base of the prostate gland, where they are joined by the ducts of the vesiculæ seminales, their union forming the *common ejaculatory ducts* ; these run through the prostate gland, and open into the prostatic portion of the urethra, at the side of the verumontanum.

Each testicle is supplied with blood by the sper-

matic artery, the blood of which is returned by the spermatic veins; it receives nerves from the spermatic plexus, which is formed by branches from the renal and aortic plexuses of the sympathetic.

Rete testis.—Upon separating the laminæ of the tunica albuginea, which form the corpus Highmorianum, the vasa recta will be seen to pass to and from the gland. The reticular appearance these present is called *rete testis*.

Vas aberrans is a small closed tube, from two inches to twelve inches, which is connected with the commencement of the vas deferens, running up amongst the vessels of the cord.

Organ of Giralddès is placed in front of the cord just above the globus major, and consists of several masses of convoluted tubes: is sometimes called *parepididymis*.

The spermatic cord is composed of the vas deferens, with its small artery, derived from the superior vesical; the spermatic artery, veins, and nerves; the genito-crural nerve, an artery to the cremaster coming off from the epigastric, and absorbents; all of which are connected to each other by fine cellular tissue, and are enveloped by fascia and the cremaster muscle. The cord, thus formed, extends from the epididymus to the internal abdominal ring, where its constituents separate from each other.

Plesnx pampiniformis is the name given to the

venous plexus formed by the spermatic veins after these vessels have emerged from the testicles.

The vesiculæ seminales are two oblong flattened bodies, situated at the inferior fundus of the bladder, behind the prostate gland, and on the outer side of the vasa deferentia. Each seminal vesicle is about two inches long, and consists of a long tortuous membranous tube, convoluted on itself, the small excretory duct of which joins its corresponding vas deferens.

The prostate gland is a flat conoidal body, the base being posterior, corresponding to the vesiculæ seminales, the apex anterior, corresponding to the vesical extremity of the urethra. It is divided into three lobes; two lateral, large, and united in the mesial line, their union being marked by a slight groove; and a third or small lobe, situated in the angle between the two lateral lobes, towards the base of the gland. The prostate gland is firm and resisting to the touch, and composed of numerous follicles, with minute ducts and muscular tissue; the ducts unite to form larger tubes, the openings of which, ten or twelve in number, are on the under surface of the urethra, on either side of the verumontanum.

Cowper's glands are two small oblong round bodies, placed before the prostate gland, and immediately behind the bulb. They lie between the layers of the triangular ligament. The duct of

each gland, having run a course of about an inch, opens into the urethra a little anterior to its bulb.

THE PENIS.

This organ consists of two long cylindrical bodies, named corpora cavernosa, and a body named corpus spongiosum, which contains the urethra, all these parts being connected together and surrounded by the superficial fascia and the common integuments.

The superficial fascia, which envelopes the penis, is derived from that of the abdomen, and terminates at the corona glandis. It is strong where it passes from the linea alba upon the dorsum of the penis, forming the *suspensory ligament*, but is exceedingly delicate and loose upon the body of the organ.

The skin of the penis is remarkably thin and loose, and extending for an indefinite length beyond the organ, is reflected inwards, and intimately attached to the corona glandis; the loose fold thus formed being called the *prepuce*. From the corona glandis it is continued along the glans until it becomes identified with the mucous membrane at the orifice of the urethra, having first formed the fold which lies posterior and inferior to this opening, called *frænum preputii*.

Glandulæ odoriferæ, are a number of small seba-

aceous glands which surround the corona glandis, and which lie beneath the skin.

The corpora cavernosa are two cylindrical bodies, united to each other for their anterior three-fourths in the mesial line. They are composed of erectile tissue, vessels, and nerves, surrounded by a dense fibrous covering.

Each *corpus cavernosum* commences by the *crus penis*, which is the narrowest part, and which is attached to the rami of the ischium and pubes, covered by the erector penis muscle. At the symphysis pubis both crura unite, forming the chief part of the body of the penis, and terminate anteriorly in an obtuse point, to which is intimately attached the glans penis.

Septum pectiniforme, a partition, imperfect, as its name implies, which corresponds to the mesial line, and marks the division of the corpora cavernosa.

The corpus spongiosum urethræ is a cellulovascular tube surrounding the urethra, and occupying the under mesial line of union of the corpora cavernosa; it commences in the bulb of the urethra, and extends along the canal to its extremity, where it terminates in the *glans penis*, the bulb and glans penis being merely expansions of this structure.

Structure of the corpus cavernosum. From the fibrous covering numerous prolongations, *trabeculae*, pass inwards, intersecting each other in all direc-

tions, dividing it into innumerable spaces, which give a spongy appearance to its structure. The trabecular tissue contains some unstriped muscular tissue, and the venous interspaces are lined with flattened epithelium cells. The arteries are supported by the trabeculæ, which, after very minute subdivision, open some into the trabecular spaces, and others terminate in curled dilated extremities called *helicine arteries*. The structure of the corpus spongiosum resembles the former, with the exception that the fibrous and trabecular tissue is much less developed.

The urethra is a membranous canal, extending from the neck of the bladder to the extremity of the glans penis, its length varying according to the erect or lax state of the organ.

In the latter condition it is from seven to eight inches long, and its calibre about three or four lines. It is lined by mucous membrane, and is distinguished into—1st, the prostatic portion, which is an inch and a quarter in length; 2nd, the membranous portion, which is about three-quarters of an inch long; 3rd, the bulbous portion, which is scarcely an inch; and 4th, the spongy portion, which occupies the remainder of its length.

Upon exposing the mucous surface of the urethra by an incision, we observe—1st, a slit-like contraction at the orifice; 2nd, behind this is a dilatation, called *fossa navicularis*; 3rd, the constant dia-

meter of the canal until we arrive at the bulb, where it becomes gradually and very slightly dilated; forming, 4th, the *sinus of the bulb*; 5th, the narrowest part of the canal, which corresponds to the membranous portion; 6th, the dilatation corresponding to prostate gland; and 7th, a contracted orifice at its termination in the bladder. In the prostatic portion of the urethra, a prominent fold of mucous membrane, called *verumontanum*, projects from its under surface, and presents in its centre a large lacuna, the *sinus pocularis*, the orifice of which is directed forwards. On either side of the *verumontanum* the prostatic sinuses are situated. Upon the upper surface of the urethra, from the orifice to the bulb, are the openings of numerous mucous follicles, directed forwards, the largest of which is about an inch from the orifice, and is called, from its size, *lacuna magna*. The ducts of the seminal glands, already described in connexion with the genito-urinary organs, open on the under surface of the urethra; the orifices of Cowper's glands open a little anterior to the sinus of the bulb, the common ejaculatory ducts on either side of the *verumontanum*, and the ducts of the prostate in the prostatic sinuses.

THE FEMALE ORGANS OF GENERATION.

The mons veneris is a soft adipose eminence, situate on the upper and anterior part of the pubes, covered by common integument, which after puberty is thickly set with hairs.

The vulva is the fissure extending from the mons veneris downwards and backwards.

The labia magna are large folds of the integuments which bound the vulva on each side, and unite below in a crescentic edge (*the fourchette*). They contain large mucous glands about the centre.

The clitoris, a small oblong conical body, placed between the upper extremities of the labia. It consists of a structure similar to the corpus cavernosum in the male, and arises by two crura from the pubes; these unite to form its body, at the extremity of which is placed a red protuberance, called the *glans clitoridis*, over which is thrown a loose fold of integument (*the prepuce*).

Meatus urinarius is about half an inch below the clitoris, and three-quarters of an inch long, and is placed at the bottom of a depression called the *vestibule*.

Labia parva, or *nymphæ*, are two red crescentic folds of mucous membrane, enclosing numerous erectile vessels; they descend, one on each side,

from the prepuce of the clitoris, and are lost about the centre of the vulva.

The hymen, when it exists, is a crescentic fold of mucous membrane, surrounding the sides and inferior orifice of the vagina.

The carunculæ myrtiformes are small reddish bodies surrounding the orifice of the vagina: they are sometimes described as the remains of the hymen.

The ovaries are two ovoidal bodies, placed, one on each side of the uterus, in the duplicatures of the peritoneum, called the broad ligaments. Each ovary, enveloped by a white fibrous membrane, consists of a pulpy brownish-grey substance, highly vascular, and containing from fifteen to twenty minute vesicles, each of which is composed of a thin membrane containing a viscid yellowish fluid; these are called the *Graafian vesicles*, in which are contained the germinal vesicles or ovum.

The Fallopian tubes are the ducts of the ovaries; each is about four inches in length, and is contained in the broad ligament, one extremity being attached to the superior angle of the uterus, into which it opens by a small orifice, the other being free, and terminating in a fringe (*corpus fimbriatum*), in the centre of which is the peritoneal aperture.

The uterus is a hollow organ of pyriform shape, and is distinguished into the *fundus*, the *body*, and

cervix. The fundus is superior and posterior, and receives at either angle the Fallopian tube: the body is intermediate between the fundus and the neck, the latter being inferior and anterior, and surrounded by the vagina: at the extremity of the neck is a small elliptical opening, surrounded by a thick margin, which, from its resemblance to the mouth of a tench, has been called *os tinæ*, as well as *os uteri*. The cavity of the uterus is small, compared to the thickness of its walls, and is of triangular shape; its superior and outer angles presenting the orifices of the Fallopian tubes, the inferior angle presenting the *os tinæ*. The uterus is placed between the bladder and rectum.

The vagina is a membrano-vascular tube, extending from the neck of the uterus to the external outlet, where it is continuous with the surface. It is composed of a reflection of integument, resembling mucous membrane, surrounded by cellular tissue, a vascular network, and the sphincter vaginae muscle; its length is about four inches, its breadth one; but, being very distensible, these measurements vary. Its lining membrane is thrown into transverse rugæ on its anterior and posterior surface, and is studded with the orifices of numerous mucous follicles. The color of the membrane varies, at the external orifice being red, and of a grey and sometimes marbled colour as it approaches the uterus.

THE MAMMÆ

Are two in number, and situated at the anterior and superior part of the thorax, and connected to the great pectoral muscle by a capsule of condensed cellular tissue. Each of these glands, of a hemispherical shape, consists of vessels and numerous lactiferous tubes, arising from sacculated blind extremities : the tubes are grouped together to form lobes and lobules ; as they approach the nipple they become considerably dilated, and form sinuses, but in the nipple they are again reduced in size, and terminate at the apex by open orifices, surrounded by delicate elastic tissue. The *nipple* is a conical process surrounded by a brownish areola, and composed externally of the integuments, which are very thin, and internally of the lactiferous tubes, together with numerous blood-vessels and muscular tissue, from which the nipple derives its property of erection.

ORGANS OF THE SENSES.

THE ORGAN OF TOUCH.

The skin is composed of the cuticle or epidermis, the rete mucosum, and the corium, or cutis vera.

The cuticle consists of strata of epithelium cells :

the deeper are elongated and perpendicular, the superficial are flattened and dried: they are deposited in thickest layers upon the soles and palms.

The rete mucosum, or Malpighian layer, is the softer and deeper part of the cuticle, and in it are found pigment granules, upon which depend the black colour of the skin in the negro.

The corium is a thick, vascular, sensitive tissue, from half a line to a line and a half in thickness. Below it is connected with the deeper structures by subcutaneous cellular tissue and fat, and superficially with the cuticle. It consists of connective tissue fibres interlacing each other, which are finer and firmer the nearer they are to the surface. Unstriped muscular fibres are intimately mixed with it wherever hairs are found. The superficial part of the corium is called the papillary, the deeper part the reticular layer; the latter contains sudoriparous and sebaceous glands, hairs, and fat; the former, the papillæ and terminations of vessels and nerves. The papillæ are conical eminences composed of corium, from $\frac{1}{100}$ to $\frac{1}{200}$ of an inch in height, and are usually arranged in curved lines, sometimes double. They are furnished with nerves, which terminate at the top in plexuses or in tactile corpuscles: besides these, a very delicate network of blood-vessels and lymphatics pass to the extremity of the papilla.

THE ORGAN OF SMELL.

The nose is bounded superiorly by the nasal, frontal, ethmoid, and sphenoid bones ; inferiorly by the palatine plates of the superior maxillary and palate bones ; externally on either side by the superior maxillary, lachrymal, inferior spongy, ethmoid, and palate bones, and by the internal pterygoid plates of the sphenoid bone. It is divided into the *two nares* by the *septum nasi*, which is formed by the rostrum of the sphenoid bone, the nasal plate of the ethmoid bone, the vomer, the mesial crests of the superior maxillary and palate bones, the crest formed by the two nasal bones, and the nasal spine of the frontal bone. Besides the bony boundaries the nose presents, anteriorly, five cartilages, which form the *anterior nares*, or the nostrils. The middle vertical cartilage is of triangular form, and rests in the fissure of the vomer inferiorly, is attached to the vertical plate of the ethmoid bone above, and presents anteriorly a subcutaneous, free, thick edge, and thus completes the *septum nasi*. The lateral cartilages which form the wings of the nose are also triangular, are attached to the superior maxillary and nasal bones, and in the median line to the vertical cartilage. The inferior lateral fibro cartilages are attached to the three cartilages just described, are thick and semicircular, forming, with

the vertical cartilage, the anterior-inferior oval openings of the nostrils.

The posterior nares are of oval shape, and open into the upper part of the pharynx; they are separated from each other by the posterior free edge of the vomer, are bounded superiorly by the body of the sphenoid bone, inferiorly by the palate bones, and externally by the internal pterygoid plates of the sphenoid bone. The external lateral wall of each nostril, from the arrangement of the spongy bones, forms three fossæ, called *meatuses*, with which several orifices communicate.

In the *inferior meatus*, at the junction of its anterior with its middle third, is the opening of the *nasal duct*, and posteriorly, on a level with the inferior spongy bone, is the opening of the Eustachian tube. In the *middle meatus* is the slit-like opening of the antrum maxillare, anterior to which is the groove called *infundibulum*, which leads from the frontal sinus, and into which open the anterior ethmoidal cells.

Into the *superior meatus* the posterior ethmoidal cells and the sphenoidal sinus open. The interior of the nose is lined with the Schneiderian membrane, which is highly vascular and sensitive, and consists of two layers; a fibrous layer, which is the periosteum, or the perichondrium of the nasal cavities, and a mucous membrane. The nerves which supply the nasal cavities are the olfactory (which

pass through the cribriform plate of the ethmoid bone), the internal nasal of the ophthalmic, and branches derived from Meckel's ganglion.

THE ORGAN OF TASTE

Is of triangular form, and is connected by its base to the os hyoides by folds of mucous membrane to the epiglottis and palate, and by muscles to the lower jaw. It is covered with mucous membrane, on which are situated papillæ, arranged in three varieties—the filiform, situated at the tip and sides; the fungiform, scattered over the dorsum; the circumvallatæ, from eight to ten in number, at the back of the dorsum. It is covered with squamous epithelium. The tongue is composed of two symmetrical halves, separated by a fibrous septum, the muscles composing each half being arranged in the following order: genio-hyo-glossus, lingualis, hyo-glossus, stylo-glossus, palato-glossus, and superior constrictor. It is highly vascular, and receives six nerves, three on each side—viz., the gustatory from the fifth, for sensation; the ninth or lingual, for motion; and the glosso-pharyngeal connected with the special sense of taste.

THE EYE AND ITS APPENDAGES.

The appendages of the eye are the following:—
The lachrymal gland, placed in the upper and

outer part of the orbit, behind the external angular process of the frontal bone, and about the size of a small almond, is of greyish colour, consists of numerous lobules united by an imperfect capsule, and pours forth its secretion of tears by means of six or seven minute ducts, which open behind the upper eyelid, in the angle formed by the reflection of the conjunctiva.

Conjunctiva, a mucous membrane which lines the interior of each eyelid, and is reflected over the anterior part of the globe of the eye. At the inner angle of the eye it forms a small fold called *plica semilunaris*, covers the *caruncula lachrymalis*, and having lined the lachrymal sac and duct, becomes continuous with the mucous membrane of the nose. The epithelial layer of this membrane is continued over the cornea.

Caruncula lachrymalis is a small vascular body composed of mucous glands and cellular tissue situated in the nasal angle of the eye, and covered by the *membrana conjunctiva*.

The *palpebræ*, or *eyelids*, semicircular in form, are composed of skin externally, which is very fine, the *tunica conjunctiva* internally, and between both the *orbicularis palpebrarum* muscle, the tarsal cartilages and their ligaments, and the Meibomian glands, together with blood-vessels, nerves, and absorbents.

The superior eyelid, besides being the larger, has

also peculiar to it the levator palpebræ superioris muscle.

The *tarsal cartilages* are thin dense connective tissue plates, of a semicircular form, the superior being the larger ; to their convex margins are attached the *palpebral ligaments*, which are continuations of the orbital periosteum.

The *Meibomian glands*, of a yellow colour, are very numerous, particularly in the upper eyelid, and are arranged in vertical rows.

The opposed edges of the eyelids are thick, and are bevelled off obliquely towards the eye, so that when closed they only touch at their anterior edges, thus leaving a triangular canal, the base of which is formed by the tunica conjunctiva, along which the tears are conducted to the puncta lachrymalia.

The *cilia*, or *eyelashes*, attached by their roots to the opposite margins of the eyelids, observe a curved arrangement, their convexities looking towards each other.

The *puncta lachrymalia* are the two minute orifices of the lachrymal canals, placed within two or three lines of the nasal terminations of the eyelids and upon their opposed edges.

The *lachrymal canals*, the superior of which is longer and curved, the inferior being nearly straight, lead from the puncta lachrymalia to the lachrymal sac.

The *lachrymal sac*, placed in the fossa formed by the lachrymal and superior maxillary bones behind the fibrous expansion from the tendon of the orbicularis palpebrarum, is of oval form, receives the lachrymal secretion by the puncta lachrymalia, and transmits it to the nasal duct, with which it is connected inferiorly.

The *nasal duct*, enclosed in a bony canal, formed by the lachrymal, superior maxillary, and inferior spongy bones, passes obliquely downwards, backwards, and outwards, and terminates in the inferior meatus of the nose.

THE EYE

Is of spherical form, and is composed of membranes or tissues enclosing fluids, called humours.

The *sclerotic coat*, occupying about four-fifths of the globe, is a strong, white, fibrous structure, and thicker behind and anteriorly than in its centre. Its outer surface is in contact with the adipose tissue of the orbit, the tendinous expansions of the muscles of the eye, and anteriorly with the conjunctiva; its inner surface is lined with the choroid coat. It presents posteriorly a small aperture, *lamina cribrosa*, for the transmission of the optic nerve, which enters at the nasal side of the centre,

and an anterior large one, above six or seven lines in diameter, for the cornea.

The *cornea*, which forms the anterior fifth of the globe, is smooth and transparent. It is about $\frac{1}{25}$ of an inch in thickness, and consists of five layers—viz., the conjunctival layer externally, which consists of a deeper layer of rounded cells, and a superficial one of columnar cells with flattened bases; an anterior homogeneous lamina; the central fibrous layer, composed of about sixty straight lamellæ of connective tissue, whose strata lie parallel to the surface of the cornea; between the strata are a number of cell spaces filled with corneal corpuscles, which exhibit amœboid movements; a posterior elastic layer, or membrane of Demours, about $\frac{1}{2500}$ of an inch in thickness, elastic and structureless; and most internally an epithelial lining. Neither blood-vessels nor lymphatics can be discovered in a healthy cornea, but the nerves are very abundant.

The *choroid coat* is a thin vascular membrane placed between the sclerotic coat and the retina; it extends from the entrance of the optic nerve to the ciliary ligament, to which it is firmly attached; it is then directed inwards and forms the folds called ciliary processes. It is composed of three layers, an external or venous plexus, which converge to four equidistant trunks, called the *venæ vorticosæ*;

a middle or fine capillary plexus, the tunica Ruyschiana; and an internal or pigmental layer, composed of hexagonal cells containing pigment granules.

Between the tunica Ruyschiana and the pigmental layer is a thin structureless membrane, the membrane of Bruch.

The *ciliary processes* vary in number from sixty to eighty, and are formed by the folding backwards of the choroid coat: each ciliary process is of triangular shape, the anterior edge being attached to the ciliary ligament, the posterior being free and resting upon the anterior aspect of the outer border of the lens.

The *ciliary muscle*; formerly described as the ciliary ligament, is composed of unstriped muscular tissue about a line in breadth. It is placed close to the junction of the sclerotic and cornea, and arises from the inner aspect of the front of the sclerotic by a thin tendon: from this its fibres spread out in a radiating manner and are inserted into the choroid opposite to the ciliary processes. At the junction of the muscle with the sclerotic there is a small circular venous canal called the *canal of Schlemm*.

The *iris* is a circular muscular membrane placed in a transverse vertical position, attached by its larger circumference to the ciliary muscle floating in the aqueous humour, and presenting a circular

opening in its centre, called the *pupil*. It divides the space between the anterior surface of the capsule of the lens and the posterior surface of the cornea, unequally, into what are termed the *chambers of the aqueous humour*, the anterior chamber being much the larger; both chambers, however, communicate through the pupil. The anterior surface of the iris presents a radiated appearance, and, varies in colour in different individuals; the posterior surface is covered by pigmentum nigrum, which has received the name of *uvea*.

The muscular tissue is unstriped and arranged into two sets, having circular (sphincter) and radiating (dilator) fibres. Pigment cells are found throughout the whole thickness of the iris.

Membrana pupillaris is a transparent membrane which closes the pupil, but gradually disappears from the seventh month of foetal life, and at birth no longer exists. It is supplied with vessels derived from the iris and the capsule of the lens. The iris is supplied by the ciliary vessel and nerves.

The *retina*, the expansion of the optic nerve, is placed between the choroid and the hyaloid membrane of the vitreous humour, and terminates in front in the *orra serrata*. It varies in thickness from the $\frac{1}{50}$ th to the $\frac{1}{200}$ th of an inch. It is of transparent pink colour, but rapidly becomes opaque. It is surrounded externally by a thin layer of hexagonal pigment cells, sometimes de-

cribed as part of the choroid. The retina consists of eight layers, which from without inwards are arranged in the following order:—1, a layer of hexagonal pigment cells; 2, the layer of rods and cones the bacillary layer, or Jacobson's membrane, consisting of rods and cones, which lie parallel to each other over the whole of the retina between the external limiting membrane and the pigmentary layer—the rods are absent at the yellow spot; 3, the outer nuclear layer; 4, the outer molecular layer; 5, the inner nuclear layer; 6, the inner molecular layer; 7, the ganglionic or nerve-cell layer; 8, the nerve or nerve-fibre layer—this latter is bounded internally by the *membrana limitans interna*. Running through the whole thickness of the retina are the Müllerian or radial fibres, which rest internally upon the limiting membrane, and, passing through the various layers, assume different shapes, and ultimately become connected with the rods and cones.

The *maculata lutea*, situated in the centre of the axis of vision, is a round spot at which all the layers of the retina are thinner; there are no rods; the cones are longer and narrower.

The *vascular layer* is formed by the branchings of the *arteria centralis retinæ*.

The *aqueous humour* is contained in the anterior and posterior chambers of the eye; is perfectly transparent, and weighs from four to five grains.

It contains about two per cent. of chloride of sodium.

The *vitreous humour* occupies about the three posterior fourths of the eye; it is contained in the *hyaloid membrane*, which not only envelopes it, but sends numerous partitions from its inner surface to form cells in which this transparent fluid is deposited. The vitreous humour thus contained in its capsule is convex posteriorly and on its lateral circumference, but presents anteriorly a concavity for the reception of the crystalline lens: around the circumference of this cavity the vitreous humour presents a striated appearance, caused by the marks of the ciliary processes, to which the term *corona ciliaris*, or zone of Zinn, is applied. Running through the centre of the vitreous from before backwards is a small canal—canal of Stilling—broader behind than in front.

The *crystalline lens*, enclosed in its capsule and placed in the anterior depression of the vitreous humour, is a transparent body, presenting an anterior and a posterior convex surface, the latter being the more prominent. Its external surface is soft and pulpy, gradually increasing in density towards its centre. It is composed of concentric layers consisting of parallel fibres united together by wavy margins, the fibres being hexagonal, on a transverse section.

The *capsule* of this body, like the lens itself, is

transparent, and composed of homogeneous membrane.

The lens and its capsule derive their nutriment from the vessels of the hyaloid membrane.

Liquor Morgagni is a fluid found some hours after death between the lens and its capsule. It is the soft external substance of the lens.

Canal of Petit.—The lens is retained in its situation by the hyaloid membrane, which, splitting into two laminæ at its circumference, pass one anterior the other posterior to its capsule; a triangular canal is thus formed, which is intersected by minute septa: this is the canal of Petit, and may be demonstrated by distending it with air, when it will present a vesicular appearance.

THE ORGAN OF HEARING.

This organ consists of the external ear, including the pinna and meatus auditorius externus; the middle ear, including the cavity of the tympanum and its appendages; and the internal ear or labyrinth, including the vestibule, semicircular canals, and cochlea.

The *external ear* consists of a fibro-cartilaginous plate covered by skin, and so moulded as to form different elevations and depressions.

The *helix* is the semicircular eminence which forms the outline of the external ear.

The *anti-helix* commences superiorly by two roots, which enclose a fossa (*fossa* of the *anti-helix*), and is situated inferior to the helix.

The *tragus* is an eminence placed anterior and inferior to the meatus externus.

The *anti-tragus* is a smaller eminence posterior to the meatus externus.

The *lobule* is a pendulous body placed underneath the anti-tragus, composed of adipose and cellular tissue.

The *concha*, a deep conoidal cavity which leads to the meatus externus, and in which the several depressions formed by the eminences just described terminate.

Fossa of the helix is a curved groove between the helix and anti-helix.

Muscles of the pinna are :—

M. *helicis major*, in front of helix.

M. *helicis minor*, from concha to base of helix.

M. *tragicus*, over tragus.

M. *anti-tragicus*, over anti-tragus.

M. *transversus auriculæ*, from back of concha to helix.

M. *obliquus auris*, at back of concha.

The *meatus externus*, an inch and a quarter in length, is a curved canal which leads from the concha to the membrana tympana ; it is lined by skin, beneath which are placed small glands (*glandulæ ceruminosæ*), which secrete the ear-wax

(cerumen). The outer half is cartilaginous, and is formed by the deep part of the pinna; the inner portion is osseous, at the bottom of which is a nearly circular groove which receives the *membrana tympani*.

The *membrana tympani*, separating the external from the middle ear, is of circular form, and consists of three layers—viz., the external or cuticular, the internal or mucous, and between both a fibrous layer. To its inner aspect is attached the handle of the malleus, which, by drawing it towards the middle ear, gives it a concave aspect externally.

The *middle ear* consists of the cavity of the tympanum and the small bones of the ear and their muscles.

The *cavity of the tympanum* is an irregular space, closed externally by the *membrana tympani*, and bounded internally by a bony partition, which separates it from the labyrinth. It is half an inch in length and presents six walls—

The *roof*, thin and bony.

The *floor*, separated from the jugular fossa by a thin plate of bone.

The *outer wall* presents the *membrana tympani*, the Glaserian fissure, and foramen chordæ anterius, which gives passage to chorda tympani nerve.

The *inner wall* presents the *promontory*, a convex eminence, which marks the situation of the first turn of the cochlea; the *fenestra ovalis*, placed

above the promontory, and to which the base of the stapes is attached; the *fenestra rotunda*, below the promontory, closed by a membrane, which separates the scala tympani of the cochlea from the cavity of the tympanum; the *aqueductus Fallopii* for the facial nerve.

The *posterior wall* presents the openings of the mastoid cells; the *pyramid*, a bony projection, hollow within, and containing the stapedius muscle; the foramen chordæ posterius for the exit of the chorda tympani nerve.

The *anterior wall* presents the openings of two bony canals, the superior lodges the tensor tympani, the inferior forming the Eustachian tube; these are separated by a bony septum, the *processus cochleariformis*.

The *Eustachian tube* is a tube leading from the tympanum to the pharynx, and is about an inch and a half long. The upper part is osseous; the lower half is cartilaginous, and terminates in front in a trumpet-shaped opening, through which the mucous membrane is continued up to the tympanum.

The *bones of the ear* are three in number, very small, and contained within the cavity of the tympanum.

The *malleus* is divided into the head, which is smooth, and articulates with the incus; the neck, which is small, and connects the head to the shaft;

the *handle* or *shaft*, which descends from the neck, and is attached to the *membrana tympani*, and the *processus gracilis*, which passes from the neck to the Glaserian fissure.

The *incus* is divided into its body, which presents a cup-like cavity for the head of the malleus ; a superior process, which is short and lies in the mastoid cells, and a long process, to the extremity of which is attached a small process of bone considered by some as a distinct bone, and called *os orbiculare*.

The *stapes* presents a small head, which is attached to the orbicular process ; a short neck ; two curved crura, which terminate in the base ; and the base itself, which is of oval shape, and connected to the fenestra ovalis.

Ligaments of the tympanum are—

Anterior ligament of the malleus passes from the anterior wall to the base of the *processus gracilis*.

Suspensory ligament of the malleus descends from the roof of the tympanum to the head of the malleus.

Posterior ligament of the incus passes from the *processus brevis* of the incus to the posterior wall.

Muscles of the tympanum are—

Tensor tympani.—O. bony canal in petrous portion of temporal bone. I. *processus brevis* of malleus. N. from otic ganglion.

Laxator tympani.—O. spine of sphenoid bone.

I. processus gracilis of malleus. *N.* chorda tympani.

Stapedius, from cavity of pyramid. *I.* neck of stapes. *N.* from facial.

The tympanum is lined with mucous membrane, continuous with the pharynx, and prolonged backwards into mastoid cells, and is reflected over the ossicula.

The *internal ear* or *labyrinth*.

The *vestibule*, placed behind the cochlea and before the semicircular canals, is a small oval cavity about $\frac{1}{4}$ th of an inch in diameter, lined by a membrane common to the labyrinth, contains a watery fluid, and presents the following openings:—viz., on its outer wall, the fenestra ovalis; on its posterior aspect, the five orifices of the semicircular canals; on its anterior wall, the orifice of the scala vestibuli; on its inner wall, the aqueductus vestibuli, the fovea hemispherica, and also the fovea hemi-elliptica; and between them the eminentia pyramidalis.

The *semicircular canals*, placed behind the vestibule, are three in number, two vertical and one horizontal; of the former, one is superior and the other posterior. The openings of these canals are only five in number, in consequence of one opening of the vertical canals being common to both. Each semicircular canal at one end presents a dilatation called the *ampulla*, the diameter of which is $\frac{1}{10}$ th of an inch; that of the canals is $\frac{1}{20}$ th.

The *cochlea*, of conical form, the base towards the internal meatus, the apex towards the carotid canal, is composed of a bony tube which makes two turns and a half round a central pillar called *the modiolus*. This tube is divided longitudinally by a thin plate, half bony, half membranous, called *lamina spiralis*, into two independent cavities, the two tubes thus formed are called the *scalæ* of the cochlea; they both unite at the apex in a cavity called *helicotrema*, and at the base of the cochlea they separate, one called *scala vestibuli*, which opens into the vestibule, the other called *scala tympani*, which opens into the tympanum by the foramen rotundum. From the *scala tympani* proceeds a narrow bony canal called the *aqueduct of the cochlea*, which terminates in a slit-like opening in the inferior border of the petrous bone.

The *membranous labyrinth* is contained within the osseous labyrinth, and assumes in the main a similar shape to the bones within which it lies. In it are spread out the divisions of the auditory nerve, separated from the osseous walls by perilymph, and within it is the endolymph. The *membranous vestibule* consists of two sacs, the *utricle* and the *sacculæ*, which are lodged respectively in the fovea hemi-elliptica and fovea hemispherica. They both contain small granules of carbonate of lime called *otolithes*. The *membranous semicircular canals*

correspond in shape to the osseous canals, but are about one-third of their diameter.

The *auditory nerve* reaches the inner ear by small foramina at the base of the meatus auditorius internus, and divides into two trunks, *cochlear* and *vestibular*. The vestibular breaks up into five branches, to the utricle, saccule, and three semicircular canals, and on section presents three layers, an external fibrous, a middle—the *tunica propria*—and an inner an epithelial lining.

The *membranous cochlear* lines separately the two scalæ. The osseous lamina spiralis is prolonged to the outer wall by the *basilar membrane*, with which it is connected by the *ligamentum spirale*. The scala vestibuli is divided by a very thin membrane obliquely stretched across the cavity, *membrane of Reissner*, into two nearly equal tubes, the inner one being the *scala vestibuli*, the outer, the *ductus cochlearis*, which at its commencement is continuous with the cavity of the saccule through a small canal, *canalis reuniens*. The floor of the ductus cochlearis is formed by the *membrana tectoria*, which runs parallel with and above the basilar membrane, and between them are contained the following structures, beginning from within:—the thickened end of the lamina spiralis, called the *limbus*, which overhangs the *spiral groove*; then a layer of cells external to these, the *rods of Corti*, an

inner and an outer set, which are arranged obliquely, so that their upper ends support each other; the cells internal to the inner rods are called *inner hair-cells*, those on the outer side the *outer hair-cells*; and most external of all is the *ligamentum spirale*, supposed by some to be muscular and analogous to the ciliary muscle.

The *cochlear division* of the auditory nerve enters the *canalis modiali*, giving off branches which emerge from canals in the *lamina spiralis*, and which, after being connected with a ganglion ramify upon the membranous lamina, where their termination is not known.

THE ABSORBENT SYSTEM

Comprehends—1st, the vessels which convey the lymph and chyle into the veins, and 2nd, the enlargements which occur in their course, called glands.

The *lacteal* or *chyliferous vessels* commence on the mucous surface of the intestines, pass through the mesenteric glands backwards towards the spine, where they terminate in the thoracic duct.

The *lymphatic vessels* are found in most situations of the body, and generally observe a deep and superficial arrangement.

Lymphatics of the lower extremities.—The superficial set accompany the external and internal saphena veins: they communicate freely in their course with the deep lymphatic trunks which accompany the deep vessels. Those which accompany the external saphena vein enter the glands in the popliteal space, whilst those accompanying the internal saphena vein ascend to the groin, and pass through the inguinal glands, having formed numerous connexions with the superficial lymphatics of the abdomen, the perineum, and the genitals. The deep lymphatics of the hip and perineum are conducted by the branches of the internal iliac vessels into the pelvis, and pass through the pelvic glands. From the inguinal and pelvic glands the lymphatics pass along the iliac vessels to the receptaculum chyli.

The *thoracic duct*.—This canal commences by a dilatation called *receptaculum chyli*, placed on the body of the second lumbar vertebra; passing between the crura of the diaphragm, it gains the posterior mediastinum, where it lies between the aorta and the vena azygos; at the fifth dorsal vertebra it crosses the spine obliquely to the left side, passing behind the œsophagus and arch of the aorta, and placed behind the left pleura and between the left carotid and left subclavian arteries; it is then conducted by the œsophagus to the left side of the neck as high as the sixth cervical vertebra, where,

making a slight curve downwards and outwards, it opens close to the external angle formed by the left subclavian and jugular veins.

Lymphatics of the upper extremities.—The superficial set accompany the superficial veins and pass through two or three glands situated at the inner condyle; having joined the deep lymphatics which accompany the venæ comites, they proceed onwards to the axilla, and pass through the axillary glands; following the course of the axillary vein, they pass beneath the clavicle, join the lymphatics of the neck, and terminate in the thoracic duct. The lymphatics of the right upper extremity and right side of the neck unite to form the *right or lesser lymphatic duct*, which opens into the right vena innominata.

The lymphatics of the trunk consist of a deep and superficial set; in the chest the former are seated between the muscles and pleura, in the abdomen between the muscles and peritoneum, the superficial being subcutaneous. The viscera contained in the chest and abdomen also have a superficial and deep layer of lymphatics, the deep being distributed through the peculiar tissue of each organ, the superficial running beneath the membranous envelope.

Lymphatics have been seen in the membranes, but not in the proper substance, of the brain and spinal cord.

PECULIARITIES OF THE FŒTUS.

The principal anatomical peculiarities of the fœtus, by which it is distinguished from the adult, are the following :—

The *thymus gland* occupies the anterior mediastinum,—the *kidneys* are lobulated, and each is covered by a cellulo-vascular body called *supra-renal capsule*, which is larger than the kidney itself,—the *liver* is very large, particularly its left lobe,—the *lungs* are compact, of a deep red colour, and sink in water, the bronchial tubes and their ramifications being void of air,—the auricles of the heart communicate by the *foramen ovale*,—at the bifurcation of the pulmonary artery an arterial trunk, about nine lines in length, called *ductus arteriosus*, proceeds to the aorta, into which vessel it opens,—the *umbilical vein* proceeds to the liver, where, having distributed some branches to its left lobe, it divides into the *communicating branch*, which unites with the portal vein and the *ductus venosus*, which opens into the vena cava inferior,—the *internal iliac arteries*, under the name of *umbilical* or *hypogastric*, turn upwards and forwards along the sides of the bladder, pass through the umbilicus, and run a tortuous course along the umbilical vein to the placenta,—and the urinary bladder is in the abdominal part of the pelvis, from the summit of which a ligamentous cord, once a

tube, called *urachus*, passes to the umbilicus. Until the seventh month the pupil is closed by a membrane, called *membrana pupillaris*, and in the male the *testes* are contained in the abdomen.

THE LARYNX.

Besides the os hyoides, the muscles, vessels, nerves, and mucons membrane which enter into the formation of the larynx, there are four cartilages and one fibro-cartilage. The os hyoides has a body ; two greater and two lesser cornua.

The *thyroid cartilage* presents anteriorly a prominent angle called *pomum Adami*, which is formed by the meeting of its alæ. Each *ala* is of quadrilateral form, and presents posteriorly two cornua ; the superior cornu is the longest, and is connected to the great cornu of the os hyoides by the thyro-hyoid ligament ; the lesser, or inferior cornu, being connected to the side of the cricoid cartilage by synovial membrane and ligaments.

The upper margin of each *ala* is connected to the os hyoides by the thyro-hyoid membrane, the inferior margin being connected to the cricoid cartilage by the crico-thyroid membrane, which is of yellow colour and elastic ; the outer surface of each is rough, and divided unequally by an oblique ridge,

the inner surface being smooth, and covered by mucous membrane.

The *cricoid cartilage* is next in size, and forms a ring; it is narrow before and deep behind; its inferior edge is connected to the first ring of the trachea; its superior edge, anteriorly, is connected by the crico-thyroid ligament to the thyroid cartilage; posteriorly it supports the arytenoid cartilages; its inner surface is covered by mucous membrane, and its outer surface is rough, and presents posteriorly a vertical ridge for the attachment of muscles.

The *arytenoid cartilages*, two in number, and of pyramidal shape, are the smallest; the apex of each is surmounted by a small moveable cartilaginous appendix; the base, concave, moves upon the cricoid cartilage; the posterior surface, concave, lodges the arytenoid muscle, the external edge is convex for the attachment of muscles, and the inner edge is flat. The apex of each is connected to the epiglottis by a fold of mucous membrane called the *aryteno-epiglottidean fold*, and the base is connected to the cricoid cartilage by synovial membrane and ligaments.

Cornicula laryngis, two small cartilaginous nodules, above the arytenoid cartilages, and contained in the aryteno-epiglottidean fold.

Cuneiform cartilages, two long cartilages also contained in the same fold.

The *epiglottis*, composed of yellow fibro-cartilage, like a leaf in shape, is connected by its stalk-like process to the angle of the thyroid cartilage, anteriorly to the hyoid bone by the hyo-epiglottidean ligament, and to the base of the tongue by three folds of mucous membrane, the central one of which is called *frænum epiglottidis*; posteriorly extend the aryteno-epiglottidean folds of mucous membrane.

The *upper opening of the larynx* is triangular with its base forwards, bounded anteriorly by the base of the epiglottis, laterally by the aryteno-epiglottidean folds, and posteriorly by the arytenoid cartilage.

The *glottis*, or the *rima glottidis*, is of triangular shape, the base is posterior, and is formed by the bases of the arytenoid cartilages; the apex is anterior, corresponding to the angle formed by the alæ of the thyroid cartilage, and the sides are formed by the chordæ vocales.

False vocal cords, or *superior*, are formed by crescentic folds of mucous membrane; within each is a thin ligament, the superior thyro-arytenoid ligament.

True vocal cords, or *inferior*, two in number, arise from the anterior aspect of arytenoid cartilages, and approaching each other are inserted in the angle formed by the alæ of the thyroid cartilage. Each ligament is composed of yellow elastic tissue.

Ventricle of the larynx, is the depression between the false and true vocal cords, and leads to a small pouch, the *sacculus laryngis*, which extends upwards between the thyroid cartilage and superior vocal cord, and contains a large number of muciparous glands.

Muscles already described.

Crico-thyroid m. renders tense the vocal cords.

Crico-arytenoideus posticus m. dilates the glottis, by separating the vocal cords.

Crico-arytenoideus lateralis m. closes the glottis by rotating inwards the arytenoid cartilages.

Arytenoideus m. closes the glottis by approximating the arytenoid cartilage.

Thyro-arytenoideus m. relaxes the vocal cords by approximating the thyroid and arytenoid cartilages.

Aryteno-epiglottideus superior is found in aryteno-epiglottidean fold.

Aryteno-epiglottideus inferior, or Hilton's muscle, passes from the upper part of arytenoid cartilage to the margin of the epiglottis.

The larynx is lined with mucous membrane covered with ciliated epithelium.

All the muscles of the larynx are supplied by the recurrent laryngeal nerve, except the crico-thyroid, which is supplied by the external laryngeal nerve.

THE THYROID BODY,

Of reddish-brown colour, consists of two lateral lobes and a connecting middle lobe or isthmus. The lateral lobes are placed by the sides of the trachea and larynx, and the isthmus rests upon the anterior aspect of the two or three first rings of the trachea. Each lateral lobe is of pyriform shape, the base inferior, and the apex ascending to the thyroid cartilage; both lateral lobes overlap the carotid vessels, the inferior thyroid artery, and the recurrent nerve; and are covered by the sterno-hyoid, sterno-thyroid, and omo-hyoid muscles, the cervical fascia, and the integuments. This body or gland is supplied with blood by the superior thyroid arteries from the external carotid, the inferior thyroid arteries from the thyroid axis, which is a branch of the subclavian artery, and sometimes by an artery from the arteria innominata, or from the aorta itself, called the middle thyroid artery; its blood is returned by the thyroid veins, which, the middle descending on the anterior aspect of the trachea, empty themselves into the left vena innominata. The superior and inferior cross the common carotid, and open into the internal jugular. Its nerves come from the laryngeal branch of the pneumogastric, and from the sympathetic. It consists of a number of vesicles connected together

by a fibrous stroma, in which ramify the small arteries. The vesicles contain a glairy fluid, in which are found nuclei, cells, and granular matter. It has no excretory duct.

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